The Conceptualisation, Measurement, and Coding of Education in German and Cross-National Surveys (Version 2.0)

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The Conceptualisation, Measurement, and Coding of Education in German and Cross-National Surveys

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Abstract

This contribution provides an overview of the theoretical conceptualisation, empirical operationalisation, and measurement and coding of education in national and cross-national survey research. In this context, *education* refers to the highest level of education successfully completed and must be distinguished from concepts such as competencies, scholastic achievements, and fields of study. Because education is often included in statistical models merely as a matter of routine, the present contribution focuses on the relationship between the theoretical concept, the indicator, the measurement instrument, and the variables. When doing so, it draws on many years of social science research on returns to education and educational inequality. It distinguishes between linear, ordinal, and categorical concepts of education that have emerged from different theoretical approaches and that, in part, place different demands on measurement and coding. Indeed, there is a distinct lack of consensus on how education should be conceptualised, measured, compared across countries, and statistically modelled. For that reason, the present contribution does not give a recommendation for a "one size fits all" education variable that would be suitable for all surveys. Rather, it endeavours to encourage readers to make an informed decision on the measurement of education in the respective research context and to support them in doing so.

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CONTENTS

1 Introduction

Together with age and sex, education is probably the most frequently used variable in population surveys and in the analyses of the resulting microdata (Smith, 1995). Despite – or precisely because of – this, education is usually inadequately specified (Braun & Müller, 1997) and its measurement tends more to follow convention than theory or evidence of validity, reliability, and comparability. Yet, the theoretical concept, the indicator, the measurement instrument, the coded variables, and the statistical model should be closely related. However, there is no consensus on how education should be conceptualised, measured, compared across countries, and statistically modelled. Similarly to the sociological debates on social status and social class, two "schools" can be distinguished for simplification purposes: the first favours a one-dimensional continuous concept of education, and thus linear modelling techniques, while the second employs a multi-dimensional categorical concept and appropriate procedures for the analysis of categorical data.

While in many studies, education acts "only" as a control variable, it is, moreover, a core concept of research on social structure, and especially research on educational inequality (i.e., education as a dependent variable, e.g. Shavit, Arum, & Gamoran, 2007; Shavit & Blossfeld, 1993) and returns to education (i.e., education as an independent variable, e.g. Shavit & Müller, 1998). The present contribution focuses on *education in the sense of the highest level of education that an individual has successfully completed* – that is, educational attainment. Thus, the perspective adopted is that of sociological research on social structure, and especially research on status acquisition and social mobility, on the assumption that the arguments advanced by researchers in these areas can often be applied also to other areas of research.

This contribution provides an overview of theoretical concepts and data analysis models, indicators, and the measurement and coding of educational attainment in German and cross-national survey research. The various theoretical approaches to the concept of education, and the data analysis models they imply, are discussed in Chapter 2 to enable readers to make an informed choice of education indicators (Section 2.3), measurement instruments (Chapter 3, taking Germany as an example), and approaches to the coding of education variables (especially for cross-national comparison purposes, Chapter 4). The contribution concludes with a summary and outlook.

2 Theories, concepts, and indicators of education

Education is often measured in surveys and "controlled" in statistical analyses as a matter of routine – that is, without previous theoretical reflection. However, *education* may mean many different things. For the measurement of education in surveys, and the coding and analysis of secondary data, it is therefore essential to specify what the data and analyses are to provide information about: (a) school attendance, (b) scholastic achievement, (c) competencies (e.g., reading skills), (d) school, vocational, and

higher education qualifications, (e) the relative position of the individual in the distribution of education, (f) fields of study, and/or (g) the duration of the educational career. Hence, in order to be able to select the most suitable concepts, indicators, and data analysis models for the specific research question, the research interest should be precisely reflected upon.

The present contribution concentrates on *formal* education provided by the state-regulated education system, which creates generally accessible programmes for the population. It focuses especially on the level of education successfully completed and marginally on educational transitions. Scholastic achievements and competencies, which have other implications for measurement and modelling, are touched on only briefly. Detailed educational trajectories, drop-outs from school and vocational education, further and continuing education and training, etc. are beyond the scope of the contribution.[1] The present chapter provides an overview of the most important theoretical approaches to the microsociological explanation of (economic and non-economic) returns to education and educational inequality and the empirical indicators and approaches to the statistical modelling of education they imply.

2.1 Educational effects: Education as an independent and a control variable

Returns to education are considered mostly from an economic perspective. Frequently, however, theoretical arguments for effects of education that do not relate to the professional success or the income achieved can also be derived from the concept.

In most multivariate analyses of survey data, education is employed "only" as a control variable. It should be recalled, however, that in order to accurately separate out the influence of education from the effects of other variables, the same measurement criteria must be applied to control variables as to variables of theoretical interest. If education as a control variable is poorly conceptualised and measured, it must be assumed that the effect of other variables will include the effects of unmeasured differences in education.

2.1.1 Education as socialisation: Human capital and incorporated cultural capital

Formal education serves primarily to formalise children's learning. There are two theoretical approaches to the socialisation effects of education. The most well-known approach is Becker's micro-economic theory of human capital (1964). According to Becker, human capital raises the individual's productivity, with the result that higher educated persons are paid higher wages than their less educated counterparts. He explained productivity gains with reference to changes in the individual – namely, the acquisition of knowledge, competencies, values, and attitudes.

This contrasts with the conceptualisation of education as "cultural capital" (Bourdieu & Passeron, 1970). *Incorporated* cultural capital comprises the linguistic competence, cultural knowledge, and attitudes

[1] For very detailed instruments for the measurement of educational trajectories, returns to education, and continuing education, see, for example, the questionnaire of the Adult Education Survey (AES): https://dbk.gesis.org/dbksearch/download.asp?db=E&id=51558 and the questionnaire for the adult cohort of the National Education Panel Study (NEPS): https://www.neps-data.de/Portals/0/NEPS/Datenzentrum/Forschungsdaten/SC6/3-0-1/SC6_3-0-1_Q_de.pdf.

that the individual needs in order to be successful in the education and the employment system. From this perspective, it is not the productivity acquired through education that is of primary importance but rather the command of (in part, elite) cultural codes and practices. The stratification of education systems ensures that pupils are "allocated" to the educational career appropriate to their class of origin: Different educational careers are associated with different learning milieus and different performance requirements, which later lead to corresponding professional careers.

What both approaches have in common is that education is perceived as a part of socialisation that *changes* people, especially through the acquisition of knowledge and the development of competencies. However, knowledge and competencies are not directly observable. Psychometric tests have been developed for individual competencies, especially literacy and numeracy, but because of their length they can be applied only in specialised surveys. These surveys include the OECD's large-scale assessment studies, the Programme for International Student Assessment (PISA, e.g., OECD, 2014) and the Programme for the International Assessment of Adult Competencies (PIAAC, OECD, 2013c; Rammstedt, 2013). As the concept of competence differs from that of educational attainment, a detailed presentation of procedures for the measurement of competencies shall not be provided here (however, see OECD, 2013a, 2013b).

Because knowledge and competencies are difficult to measure, they are often measured indirectly via years of education or educational qualifications. This approach is based on the assumption that the more years people spend in the education system, or the higher their final educational qualification is, the greater their knowledge and competencies will be. From the perspective of human capital theory, people invest time in education in order to achieve higher earnings. Hence, in that theoretical context, the most widely used education indicator is years of education (see Section 2.3.1).[2] By contrast, researchers who adopt a cultural capital perspective tend more to work with categorical educational indicators that distinguish qualitative differences, for example school types, as is usually the case with educational qualifications (see Section 2.3.2). It is widely recognised that neither years of education nor educational qualifications are particularly good indicators of competencies because, although strong, the link between competencies and years of education or educational attainment is by no means perfect (OECD, 2013c).

Although the focus in educational institutions is usually on "productive" learning – that is, on the acquisition of knowledge and competencies for the labour market – attitudes and values are also transmitted. Education is, in fact, one of the strongest predictors of many social and political attitudes, and its effect can be summarised by saying that it promotes individualistic thinking (Weakliem, 2002). Theoretical approaches to explaining this phenomenon include the "enlightenment thesis" and the "core values thesis". While the enlightenment thesis assumes that education leads universally to more liberal attitudes and to scepticism towards traditions, the core values thesis postulates that every society ensures the transmission of its core attitudes and values. Here, too, the duration of education and the highest educational qualification achieved are considered to be the most important indicators of the extent of the socialisation experienced (Weakliem, 2002).

[2] However, this is also due to the fact that this research was conducted in the USA where, because of the low level of institutional differentiation at the time, education was measured almost exclusively in years.

If education is measured in years, or if it is scaled to create a linear variable (see Section 4.1), this variable should be included linearly in the regression analysis (see, e.g., Mincer, 1974). It is assumed here that there are no differences in the effects of different levels of education and educational milieus and that the observed correlation can be expressed by means of a single parameter. That means, for example, that a year of primary education has the same effect as a year of vocational education and training or university education, and that a year in different school tracks has a constant effect across tracks. This assumption of linearity has been confirmed for Germany by Helberger (1988), who analysed income on the basis of the data from the first wave of the German Socio-Economic Panel (SOEP), while other authors have been able to demonstrate for the USA, for example, effects of qualifications that went beyond linear or even level-specific educational effects (e.g., Goodman, 1979; Jaeger & Page, 1996; Park, 1999). Using a linear education variable, it is also possible to estimate complex effects, for example by including years of education squared or interactions with other variables in the model, if this is suggested by the hypotheses to be tested (see, e.g., Weakliem, 2002).

2.1.2 Educational qualifications as signals and as status symbols

Besides the above-mentioned concept of incorporated cultural capital, Bourdieu and Passeron's cultural capital theory (1970) describes the concept of *institutionalised cultural capital*, that is, educational *certificates* by means of which the incorporated cultural capital is objectified, as it were, and given social legitimation. An educational certificate proves that the holder has passed certain exams and is thus in possession of corresponding competencies and knowledge

Once obtained, such certificates develop a symbolic effectiveness beyond the individual's actually existing knowledge and competencies. The highest level of education successfully completed not only reflects the extent of the individual's education-related socialisation, as direct effects of education. Especially in the form of educational certificates, it is also a signal for other characteristics of the individual that are relevant for productivity – for example, cognitive abilities, conscientiousness, discipline, learning ability, or motivation (Arrow, 1973; Spence, 1973). This plays a role especially in selection processes in the education system or in the labour market, where selection committees or employers cannot observe the applicant's characteristics directly but rather must deduce them from available information, such as educational certificates. Conversely, individuals invest in the acquisition of educational qualifications in order to be able to give employers a signal of their abilities. Specific fields of education and training by which vocational and higher education qualifications can be further differentiated also have a specific signalling effect. The strength of the signalling effect of educational qualifications is linked to the structure of the education system. Stratification, standardisation, and vocational specificity of qualifications within an education system increase the signalling effect (Allmendinger, 1989; Bol & van de Werfhorst, 2011).

More extreme variants of this interpretation of educational qualifications have been developed from a conflict theory perspective and can be subsumed under the concept of *credentialism*. For example, Collins (1971, 1979) and Kerckhoff (1976) developed the allocation theory, according to which educational qualifications prove membership of a cultural and social elite rather than the possession of knowledge and competencies or other productivity-related characteristics. They thus serve as a means

of social exclusion, of fending off competition, and of exercising power. Accordingly, education is often employed as an indicator of social status, true to the motto "knowledge is power".[3]

If, following these approaches, education is specified as a multi-dimensional concept in qualification categories, data analysis is more complex than in the case of the linear analysis of years of education. First, it must be decided how levels of education and educational qualifications are to be coded (see Section 4.2). This relates both to the logic of the classification and the level of detail of the education variables. Next, it must be decided whether the education variable can be modelled nominally or ordinally. If educational qualifications are not hierarchically related, a nominal measurement level must be assumed. In this case, the education variable is transformed into dummy variables for the analysis. The strength of the effects of different education categories may then differ "freely". If the dependent variable is also categorical, log-linear models can also be computed (see, e.g., Wolbers, Graaf, & Ultee, 2001). If there are clear theoretical arguments in favour of a hierarchical character of the categories, the variable can also be specified as an ordinal effect in the statistical model (Winship & Mare, 1984). Frequently, even linear effects are estimated. In this case, it is advisable to test the assumption of linearity by means of thorough sensitivity analyses by comparing the model with regard to its explanatory power and the stability of the effects of other variables to a model in which education is coded using dummy variables. Otherwise, linear modelling is statistically inappropriate and leads to distortions (Winship & Mare, 1984). In the case of ordinal models, the proportionality assumption should be tested accordingly.

2.1.3 Education as a positional good

The theories presented above assume that educational attainment in an absolute sense leads to advantages in the labour market, regardless of the educational attainment of others. A alternative approach to understanding the role of education emphasises the social context of the individual and the relationship between supply and demand in the labour market: The value of a person's education, and thus the returns to education, also depend on the amount of education that his or her peers have acquired. Educational qualifications enable employers to rank applicants and to select them accordingly, whereby education serves as an indicator of the individual's ability to learn, and thus, of training costs (Hirsch, 1977; Sorensen, 1979; Thurow, 1975). This model of the "labour queue" conceptualises education as a positional or relative good – that is, what counts is a person's relative position and not his or her actual skills.

Phenomena such as over- and underqualification and the devaluation of educational qualifications can also be addressed within the framework of theories of positional educational effects: The signalling effect of specific qualifications changes as a result of the upward shift in the distribution of education over time (see, e.g., the severely decreased reputation of compulsory schooling certificates in many developed countries and the phenomenon of degree inflation). In a cross-nationally comparative study, Bol (2015) demonstrated that educational expansion is associated with an increase in the importance

[3] In this case, however, the measurement of social status is no longer independent of the measurement of the signaling effect of the educational qualification (see below) or socialisation. It is therefore better to derive social status from the individual's occupational position and to avoid confounding it with other concepts such as education or income (see, e.g., Ganzeboom, de Graaf, & Treiman, 1992).

of positional aspects of education for the income achieved. Because there are many ways of constructing a positional measure of education, the type of statistical model of educational position used depends on how precisely the measure is constructed (see Section 2.3.3). Usually, an interval-scaled variable is created and analysed linearly.

2.2 Educational inequality: Education as a dependent variable

When researching educational attainment, scientific interest usually focuses on ascriptive factors that influence educational success, such as social background, sex, or migration background, and on those factors that explain the dependence of educational success on ascriptive characteristics. Depending on the research interest, both years of education and educational qualifications may be investigated. However, it is important to be aware of the implications that the respective choices have for data analysis and the interpretation of the results. In research on educational inequality, the complexity of the models has increased considerably in line with theory development. In what follows, the main approaches will be briefly presented in chronological order. For an overview, see also Breen and Jonsson's (2005) and Simonová & Katrnák's (2011) reviews and Rohwer's (2012) extensive presentation of research in this area.

2.2.1 The status attainment model and resources for educational success

Modern research on educational inequality began with analyses of the variance in years of education among American males within the framework of Blau and Duncan's path-analytical stratification model (1967). In this model, the education of the individual acted both as a dependent and as an independent variable – that is, as a mediating variable – between the occupation and education of the father and the occupation of the son. Education was modelled linearly, with years of schooling (see Section 2.3.1) deemed to be a suitable education indicator (indeed, it was usually the only indicator available at the time). The so-called "Wisconsin model" (Sewell, Haller, & Portes, 1969) enriched Blau and Duncan's simple stratification model with mediating social psychological variables (e.g., aspirations) in order to explain the association between social background and educational success. Simple multiple linear regressions (i.e., without a path model) are also common (e.g., Hauser & Featherman, 1976; Triventi, Panichella, Ballarino, Barone, & Bernardi, 2015). However, Winship and Mare (1984) suggested that regression models with ordinal variables should be used to analyse years of education, because each year of education is not equally easy to attain.

The association between educational success and social background is explained by economic, cultural, and social resources: Members of higher social classes have more of these resources at their disposal than members of lower classes. Hence, the former can give their children advantages in the acquisition of education. For example, in primary socialisation, children learn things directly from their parents – especially language. Moreover, parents can help their children with their homework, pay for a private tutor, or find support in their social network. Children from better-off families are better adapted to the expectations and norms of the education system and have a better command of the required cultural codes (Bourdieu and Passeron, 1970). Furthermore, children from higher-status families enjoy better conditions with regard to nutrition and health, which favourably influences scholastic achievements. These theoretical approaches can be applied to different educational indicators.

2.2.2 Primary and secondary effects: Educational choices as rational action

Dissatisfaction with the linear concept of education has grown since the 1970s because of its inability to capture the process of the gradual accumulation of education through educational choices. From a decision theory perspective, an individual's educational attainment, and thus educational inequality, is a consequence of the interplay between family circumstances and educational choices in the life course. Boudon (1974) therefore distinguished between the primary and secondary effects of educational inequality. Primary effects describe the influence of the parents on the child's *scholastic achievements*. Genetic, social, and cultural resources play a role in this regard (see Section 2.2.1). Secondary effects, on the other hand, denote the influence of the parents on educational *choices*, controlling for scholastic achievements. Secondary effects are a consequence of families' differing economic and cultural resources (including knowledge about, and own experiences of, higher levels of education), which, in the case of higher-status families, reduce the costs of higher levels of education and increase the expected usefulness and subjective probability of educational success. Moreover, in higher-status families, the expected usefulness of education increases because, in this case, it is not only an investment good but also a consumption good. The relative educational aspirations also differ because status maintenance calls for a higher level of education in higher classes than it does in lower classes. This approach is therefore characterised by a clear process orientation and the fact that it adopts the perspective of a rational agent.

The linear model has also been increasingly criticised because it does not take into account changes in the marginal distributions of the dependent variable – that is, educational expansion – and is thus unable to distinguish structurally determined changes in educational inequality from "net" changes (Mare, 1981). Decreasing educational inequality would then result solely from educational expansion without there having to be any changes in social mechanisms of the generation of educational inequality. For this reason, Mare (1980, 1981) developed a model that models educational *choices* and *transitions* as a function of social background as a sequence of conditional logistic regressions. From the earliest to the latest educational transition, it is analysed whether the respective transition is realised or not, provided the previous transition has already been successfully mastered. The results are usually depicted as "odds ratios" and compared across cohorts and/or countries. Time and again it has been found that later educational transitions are associated with less educational inequality than earlier transitions. Educational transitions can be derived from *years* of education (see Section 2.3.1) and from educational *qualifications* (see Section 2.3.2; for details, see Section 4.2.1).

The development of rational choice theories to explain educational inequality has made some progress since then (see Breen & Goldthorpe, 1997; Erikson & Jonsson, 1996; Esser, 1999; Gambetta, 1987; Hillmert & Jacob, 2003). For two decades, the Mare model was the standard model used in educational inequality research, and it inspired numerous publications (e.g. Hauser & Andrew, 2006; Müller & Karle, 1993; Shavit & Blossfeld, 1993). Moreover, building upon it, the model of primary and secondary effects (Boudon, 1974) was increasingly implemented empirically (Jackson, Erikson, Goldthorpe, & Yaish, 2007; Jackson, 2013). Path models and structural equation models of educational inequality have increasingly receded into the background.

In recent analyses of educational inequality, education has been increasingly conceptualised as a positional good – in other words, it has been explicitly conceptualised as an investment good (see the

special issue of *Research in Social Stratification and Mobility*, "Education as a positional good", edited by Park & Shavit, 2016) because "*parents and children may themselves view education in relative terms*" (Bukodi & Goldthorpe, 2016: 6) and may take credential inflation into account in their educational choices (Triventi et al., 2016). Categorical positional education measures are modelled using categorical data analysis procedures (Bukodi & Goldthorpe, 2016), while interval-scaled positional measures are modelled using linear procedures (Rotman, Shavit, & Shalev, 2016; Triventi et al., 2016).

2.2.3 Educational choices in horizontally differentiated education systems

Limitations of the logit model for the analysis of educational transitions have, however, become increasingly clear. One limitation relates to the theoretical and empirical specification of the dependent variables. Many educational choices cannot be meaningfully represented in binary form – educational transition realised or not realised. In most education systems, including that of the USA, graduates of an educational programme can access several educational programmes or institutions. There is a long-standing hypothesis that stratified education systems – in particular those with early selection into differentiated education programmes at secondary school level – encourage educational inequalities (Dahrendorf, 1965; Erikson & Jonsson, 1996; Kerckhoff, 1993; Oakes, 1985). Moreover, in the course of the increasing expansion of higher education systems, greater diversification of these systems can be observed.

When making educational choices, the structure of the education system therefore plays an important role in the individual's definition of the situation, and thus in the conceptualisation and measurement of education at the micro-level. Not only the level of education successfully completed but also the quality of educational programmes at that level – that is the type of educational qualification, the educational institution attended, and the field of education and training – are increasingly becoming characteristics of educational attainment that reflect educational inequality (Breen & Jonsson, 2000; van de Werfhorst, de Graaf, & Kraaykamp, 2001) and act as catalysts for unequal employment and status opportunities and also for socio-cultural and political attitudes. However, if educational careers are conceptualised via years of education or as a sequence of binary decisions, the role of stratified school systems or differentiated vocational education and training and higher education systems remains obscure. A purely "vertical" view of the individual level of education thus increasingly reaches its limits.

For this reason, the Mare model was further developed into a multinomial transition model (Breen & Jonsson, 2000), thereby also enabling path dependencies (i.e., the effects of previous educational choices) in a diversified secondary or tertiary education system to be modelled (Shavit et al., 2007). Using multinomial logit models, educational inequality can be estimated more precisely than with binary logit models, which must, by necessity, greatly simplify the structure of education systems.[4] Soon after Breen and Jonsson's (2000) publication, Lucas (2001) brought together the theoretical and empirical traditions of research on educational transitions and research on stratification in school systems (especially in relation to the American "in-school tracking") by assuming stratified education programmes both before and after an educational transition. According to his thesis, whether vertical or horizontal ine-

[4] The coefficients of logistic regressions should not be compared across models, educational transitions, or countries because the scale of these coefficients is not fixed, but rather is dependent on the error variance (see also Mood, 2010). This problem is also taken into account by Breen and Jonsson (2000).

quality is to be expected depends on the context: "On the one hand, if quantitative differences are common, the socioeconomically advantaged will obtain quantitative advantage; on the other hand, if qualitative differences are common, the socioeconomically advantaged will obtain qualitative advantage" (Lucas, 2001: 1652). In his analyses, Lucas used an ordered probit model (see also Winship & Mare, 1984) because the categories available for selection yielded a clear hierarchy in his data.

2.2.4 Educational attainment as the outcome of the educational career

The focus of theoretical interest may also be on educational attainment itself (i.e., the overall result of the educational career) rather than on individual educational transitions. Although similar to the multinomial transition model, the analysis of the intergenerational transmission of education and the association between social origins and educational attainment in log-linear and log-multiplicative (UNIDIFF) models, which is inspired by analyses of social mobility (Erikson & Goldthorpe, 1992; Xie, 1992), focuses on educational attainment rather than on educational transitions. To date, however, few attempts have been made to investigate education in this way (Bukodi & Goldthorpe, 2016; Müller & Karle, 1993; Pfeffer, 2008, 2015). Occasionally, ordered logit models are used (Breen, Luijkx, Müller, & Pollak, 2009). Here, the educational career recedes into the background once again, and the overall outcome of education is analysed. One criticism levelled at these models from the perspective of the theory of rational action is their assumption that actors decide at the beginning of their educational careers what qualification they wish to achieve (Breen & Jonsson, 2000). However, these models may nonetheless be useful, especially when educational career data are not available and must therefore be inferred from the highest educational qualification (see Section 4.2.1).

Multinomial regression models and log-linear models require large samples. Moreover, it is more difficult to specify the required categorical variables for cross-national comparison than in the case of sequential logit or linear models. In particular, qualitative differences between education programmes vary greatly across countries, or may even be country-specific (Lucas, 2001). The coding of the corresponding variables is therefore a very challenging undertaking (see Section 4.2). Furthermore, these models produce a large number of parameters, which are difficult to interpret. For this reason, Hauser and Andrew (2006) proposed an ordered logit model with partial proportionality constraints, which also models all educational transitions in a single model. However, here, too, the existence of a sequential *binary* decision situation is assumed.

2.2.5 Selection effects and unobserved heterogeneity in the Mare model

A further criticism levelled at the Mare model (see Section 2.2.2) relates to the fact that it neglects unobserved heterogeneity and thus dynamic selection effects across educational transitions. The sample shrinks from educational transition to educational transition and becomes more and more homogeneous with respect to unobserved variables – for example, motivation and cognitive abilities – that correlate across transitions and influence the probability of transition (Cameron & Heckman, 1998). As a result, errors occur in the estimators of the effects of social background. If these are taken into account, the effects are also more pronounced in the case of later educational transitions than reported elsewhere in the empirical literature. Cameron and Heckman (1998) therefore proposed an ordered discrete-choice model that takes unobserved heterogeneity into account via latent classes. They thus returned to the analysis of years of education (with all its theoretical shortcomings).

Although other authors (e.g., Holm & Jæger, 2011) have proposed alternative models to deal with this problem, unobserved heterogeneity is largely neglected in current research (however, see the special issue of *Research in Social Stratification and Mobility* edited by Buis, 2011). Some authors in the field of sociological research on educational inequality fundamentally criticise the rejection of the educational transition model by Cameron und Heckman (see, e.g., Lucas, 2001; Rohwer, 2012). However, this cannot be gone into here.

2.3 Summary of educational attainment indicators

The above presentation of the theoretical concepts of, and approaches to, modelling education as an independent or dependent variable has made clear that, depending on the epistemic interest, there are different ways of conceptualising education. In the present section the various empirical indicators of educational attainment – years of education, highest educational qualification, and positional education – are summarised and their validity (see, e.g, Rammstedt et al., 2014) for different research questions is examined.

2.3.1 Years of education

The apparently simplest education indicator is the total duration of education in years. *Years of education* measures how long an individual has been "exposed" to the education system, which can be interpreted in the sense of (a) the extent of scholastic socialisation, (b) the time invested in human capital, or (c) the quantitative use of educational opportunities. Thus, it is expected that the total duration of education will correlate highly with knowledge, competencies, and attitudes. Educational transitions are also sometimes derived from years of education (see Section 2.2.2). Like educational qualifications, years of education is initially an absolute measure of education to which "more is better" applies and for which the relative position of the individual in the *distribution* of education is immaterial. And finally, as a metric variable, it is easy to analyse (see Sections 2.1.1 and 2.2.1).

Two ways of operationalising years of education can be distinguished: actual years of education, which is collected directly (see Section 3.1), and theoretical years of education, which is derived from the highest educational qualification (see Section 4.1.3). Helberger (1988) argued that the labour market assesses outputs of qualifications rather than the individual investment in education. Accordingly, within the framework of human capital theory, the best operationalisation of education would be the average or institutionally required number of years of education to attain a qualification and not the number of years that an individual actually completed.

Years of education is suitable only to a limited extent for use as a proxy variable for competencies as it cannot capture the differing intensity of different education programmes. For example, the (theoretically and empirically) longer duration of an educational programme may be due to the lower learning capacity of the students who typically participate in it. A longer (actual) duration of education may also arise as a result of detours on the path to the highest educational qualification. The duration of education does not reflect other qualitative characteristics of educational attainment, either – for example, whether a vocational education qualification or a university degree was obtained – although this may be very strongly associated with differences in competencies. Years of education cannot cap-

ture differences in competencies as a result of attending different school types and obtaining different types of qualifications with the same duration of education.

By the same token, the signal character of educational qualifications (see Section 2.1.2) does not have an effect in the case of the indicator *years of education*. Indeed, compared to alternative indicators of educational attainment, the power of years of education to predict social status, which can be regarded as a measure of its validity, is low and varies greatly across countries (Braun & Müller, 1997; Schneider, 2010). If, for theoretical reasons – for example when predicting social status – signalling effects are assumed, the indicator *highest educational qualification*, which is presented in more detail in what follows, should be chosen instead.

2.3.2 Highest educational qualification

The highest educational qualification reflects, on the one hand, the duration of education and training because several educational programmes must normally be successfully completed in order to achieve a specific qualification. On the other hand, it reflects educational *success* because examinations must usually be passed in order to obtain a qualification. Hence, the highest educational qualification serves as a proxy for competencies. However, educational qualifications and the measures derived from them (e.g., hypothetical years of education) are suitable only to a limited extent as a proxy for competencies. For example, unfinished education and training ("dropping out"), which may well result in increased competencies and income (Hübler, 1984), is ignored. Moreover, competencies are also acquired outside the education system – especially in professional life. However, it has been shown that low qualifications (in the sense of failure to complete upper secondary education) can be regarded as a valid indicator of low competencies (Steedman & Murray, 2001). And finally, every qualification has a certain signal character, for example in the case of qualifications that are considered to be very demanding and thus difficult to obtain, or qualifications that imply specific educational and training content. Thus, educational qualifications contain very concrete information on the type of education and training successfully completed. This information is decisive, especially for selection processes in the labour market. In the absence of data on educational pathways, educational transitions are usually derived from the highest educational qualification. However, in contrast to years of education, educational qualifications cannot be analysed with linear procedures (see Sections 2.1.2 and 2.2.2). Like years of education, educational qualifications are initially absolute measures of education for which the relative position of the individual in the distribution of education is immaterial.

When measuring educational qualifications, it is assumed that there are no important differences within the categories covered. Changes in the qualifications over time are also ignored – for example, the extension of the duration of compulsory education in many countries, possibly leading to (nominally) the same educational certificate before and after educational reforms. Moreover, it is assumed that the school type in which the qualification is obtained makes no difference. Nowadays, however, school qualifications can often be obtained via different pathways (e.g., in Germany, lower secondary school leaving certificates can also be obtained at vocational schools after leaving lower secondary school; Helberger, 1988; Schuchart, 2006). Different school types may constitute an important "milieu for development", so that different education and training pathways may be associated with differences in achievement levels. This is known, for example, from regional comparisons within Germany (Trautwein,

Neumann, Nagy, Lüdtke, & Maaz, 2010). Ideally, therefore, the information about the type of educational institution attended would be collected with a separate questionnaire item.

A further problem with the indicator *educational qualification* is that educational qualifications also change qualitatively over time. Taking a German example, a *Hauptschule* leaving certificate from the 1950s is different from a *Hauptschule* leaving certificate from the 1970s (Helberger, 1988; Müller, 1979), which is, in turn, different from the *Hauptschule* leaving certificate of today. The same can be said of practically all educational qualifications. Hence, the social and performance prerequisites for the successful attainment of a qualification, and the life chances associated with it, will hardly be comparable over time. It is therefore useful also to record the year in which the educational qualification was obtained and to include this information in statistical models or use it to distinguish educational cohorts. The scaling of educational qualifications or the use of positional measures of education is recommended in order to capture such relative changes over time (see the following section).

2.3.3 Relative or positional measures of education

Positional concepts and measures of education include the social context (e.g., in the form of educational cohorts or the value of education in the labour market) in the measurement of education, thereby specifying it relatively rather than absolutely, as in the case of years of education or educational qualifications. Thus, different research questions and hypotheses can be investigated with positional measures than with absolute measures, so that the measurements, too, can meaningfully complement each other (Rotman et al., 2015). Relative educational concepts have been used for a long time in research on returns to education. However, in research on educational inequality, absolute measures of education as dependent variables have been used almost exclusively, although relative measures might be more appropriate for theoretical reasons (Bukodi & Goldthorpe, 2016; Triventi et al., 2016).

Positional measures of education cannot be asked about directly. There are two possible approaches to the empirical analysis of education as a positional good (see Sections 2.1.3 and 2.2.2). First, years of education and/or educational qualifications can be transformed by means of several procedures into interval-scaled or ordinal variables (see Section 4.1.2), and/or second, they can be scaled with the help of further variables (see Section 4.1.3). When the second approach is used, credential inflation and the corresponding devaluation of educational qualifications as a result of educational expansion can be taken into account. The aim of the first approach is to capture the position of an individual within the distribution of education in his or her own cohort, and thus its scarcity (Rotman et al., 2016). Both approaches yield relative measures of education but in a different sense: Positional measures of education in the narrow sense are relative to the individual position in the distribution of education itself, while scaled educational variables are relative to a further variable. Neither types of relative measures of education provide information about the absolute level of education that an individual has successfully completed.

2.3.4 Combination of different education indicators

When it comes to validity, the actual duration of education can, strictly speaking, be used as a *sole* indicator of education only if it is a matter of measuring the individual duration of education and training (i.e., the **duration of the individual's socialisation in the education system**). The *theoretical*

duration of education (i.e., the number of years required to attain a qualification by the direct route without repeating or skipping a year) is a more suitable indicator if the school system is so uniformly organised that everyone has practically the same experiences – which is hardly ever the case (Braun & Müller, 1997). If the focus is more on investment for the labour market than on socialisation, positional measures of education derived, for example, from years of education in the sense of the time invested in education, are appropriate. The signal character of education can best be captured by a categorical conceptualisation of education and by choosing the indicator *educational qualification*, from which a positional measure of education can also be derived.

However, there is also a fourth way of incorporating education as an independent variable into regression models, namely, to combine different education indicators, for example a positional measure and educational qualifications, or years of education and educational qualifications. This can also be justified with reference to the signal theory and to credentialism, for example (see Section 2.1.2), where the aim is to estimate the effects of educational qualifications independently of the duration of education and training (Section 2.1.1) or the relative position in the "labour queue" (Section 2.1.3; see, e.g., Bol & van de Werfhorst, 2011; Goodman, 1979). In such models, the required number of categories for educational qualifications is usually smaller than when only a categorical variable is used.

3 Instruments for the measurement of education

Following the summary of the main concepts, theories, and indicators of education in Chapter 2, the measurement instruments can now be presented. How can survey respondents be asked about years of education and educational qualifications in such a way that the required education variables, including positional measures of education, can be coded from these data (see Chapter 4)? To avoid making this contribution excessively long, the presentation will be limited exemplarily to the German education system and to face-to-face surveys. First of all, however, some general information will be provided about instruments for the measurement of socio-demographic characteristics, especially education.

As is often the case with so-called socio-demographic background variables, the fact that, strictly speaking, different theoretical approaches call for different concepts of education, statistical models, and correspondingly different measurement instruments constitutes a considerable challenge (Müller, 1979). Multi-topic surveys clearly face greater demands than small, focused studies because their instruments must cover the entire spectrum of theoretical concepts and indicators. Cross-national multi-topic surveys, such as the European Social Survey (ESS) or the International Social Survey Programme (ISSP), are faced with even greater challenges: Things that are quite difficult even in the national context become a great methodological challenge in cross-cultural or cross-national comparative survey research.

Validation of measurement instruments is relatively difficult because a benchmark in the sense of a "true value" is usually not available. In general, however, it can be said that more differentiated measurement instruments yield variables with greater predictive power and thus greater validity. In order to ensure good measurement quality, it is advisable to measure education as broadly (i.e., by means of several indicators) and in as much detail as possible (Braun & Müller, 1997). For example, it is useful to

measure actual years of education and detailed educational qualifications independently of each other. This enables secondary researchers to subsequently select those aspects that are important from a theoretical point of view for a specific research question. Moreover, a differentiated measurement is helpful when it comes to harmonising variables – that is, rendering them comparable across countries (see Chapter 4) – because it is easier to identify common boundaries between categories without ignoring country-specific particularities.

In many surveys, respondents are asked not only about their own level of education but also about the educational attainment of their parents, spouse or partner, or children. In some household surveys, the "head of the household" often provides information about all family members. Proxy interviews presuppose relevant knowledge, which is problematic especially in the case of children or adolescents who are supposed to provide information about their parents, or in migrant families whose members hold educational qualifications from different countries. A more detailed discussion of this point is not possible here (but see Black, Sanders, & Taylor, 2003; Kerckhoff, Mason, & Poss, 1973; Kreuter, Eckman, Maaz, & Watermann, 2010; Schimpl-Neimanns, 2013). However, proxy interviews should be avoided where possible.

After choosing the indicators to be measured, the types of education to be taken into account must be clarified. Generally, only *formal education* is measured, because non-formal and informal education processes (i.e., education outside the state-regulated education system)[5] are very heterogeneous. Special instruments for the measurement of such non-formal and informal education processes – for example, for the self-assessment of language skills and for non-formal continuing professional education and training – have been developed within the framework of specialised surveys such as the German National Educational Panel Study (NEPS; Blossfeld et al., 2011, especially Chapter 6), the Adult Education Survey (see also http://www.gesis.org/en/missy/metadata/AES/), and the German Socio-Economic Panel (SOEP, Wagner, Frick, & Schupp, 2007).

In surveys, both school and higher education as well as formal vocational education and training (school-based or in a dual system, for those countries who have both) are usually measured. Apart from the fact that school and higher education represents only part of the educational success of an individual, it is especially important when comparison with other countries is intended. In contrast to countries like Germany, vocational education and training in many countries is almost impossible to separate from general education, as it is often provided at full-time schools and is less occupation-specific. Purely enterprise-based training measures with employment character that do not lead to a further educational qualification or a more advanced level of education (e.g., internship, traineeship, probationary year) are not classified as formal education. However, they are taken into account in the German Microcensus (see http://www.gesis.org/en/missy/metadata/MZ/) if they last for at least 12 months.

The following aspects are immaterial for the measurement of educational attainment: (a) whether an educational programme was attended on a full-time or a part-time basis (b) the respondent's age at the time of completion, (c) whether a qualification was obtained within the framework of initial education and training, (formal) continuing education and training (i.e., after entering professional employment), a second-chance programme, or onsite or distance learning, (d) whether a state or a private

[5] For the definition, see UNESCO Institute for Statistics (2012, sec. 4 and Annex V).

educational institution was attended, and (e) which field of education and training was chosen. If these aspects are of interest, they must be collected with separate survey questions.

3.1 Years of education

Years of education can be measured directly, as presented in this section, or derived from educational qualifications and educational careers (see Sections 3.3 and 4.1.3; for the justification of the choice, see Section 2.1.1). Because, in Germany, educational qualifications are a more meaningful indicator for national purposes than duration of education, the German Demographic Standards (*Demographische Standards*, Hoffmeyer-Zlotnik et al., 2010) feature only standard questions for the measurement of educational qualifications and no question about years of education. In the international context, where years of education is often used as an education indicator because of its intuitive comparability regardless of theoretical considerations, several different question formats are in use. They can be divided into two types:

- A question about the *age* at which the respondent left school, completed full-time education, or obtained his or her highest educational qualification, for example in the source questionnaire of the European Quality of Life Survey (EQLS) 2011: "How old were you when you completed your full-time education?"; or in the German questionnaire of the European Values Study (EVS) 2008: "In welchem Alter haben Sie Ihren höchsten allgemeinen Schul- oder Hochschulabschluss erworben?" (At what age did you obtain your highest general school-leaving certificate or higher education degree), or in the Eurobarometer "How old were you when you stopped full-time education?" The World Values Survey also features a question about the age at which education was completed.

- A question about the entire *duration of education* in years, for example in the ESS Germany 2012: "Wie viele Jahre haben Sie insgesamt eine Schule besucht, inklusive den etwaigen Besuch einer Berufsschule oder Hochschule? Berücksichtigen Sie bitte alle Voll- und Teilzeitausbildungen, und rechnen Sie die Gesamtdauer Ihrer Schul- bzw. Ausbildungszeit in ganze Jahre um." (How many years did you attend school, including possible attendance at a *Berufsschule* or a *Hochschule*? Please take into account all full-time and part-time education and training and convert the total duration of your education and training into full years.) Here, too, the specific wording of the question differs across surveys (see also Hoffmeyer-Zlotnik & Warner, 2007).

The advantage of the first type of question is that, biographically, the transition from education to employment is such a decisive event that it is probably relatively easy to recall the year when, or the age at which, it was made. However, the question is problematic when there are breaks in the educational career, that is when a person re-enters (full-time) education later in life. The question is based on the assumption that this does not happen, which is not correct, especially from a cross-national comparative perspective. Moreover, in cross-nationally comparative data, comparability problems occur because children do not start school at the same age in all countries.

In the second question type, on the other hand, the respondent has to calculate the total duration of all education programmes attended, which can be very cognitively demanding. The brief information for the respondent and the detailed instructions for the interviewer in the German ESS questionnaire[6]

[6] The international source questionnaire is much more simply structured and the question underwent extensive adaptation during the translation process. It must be assumed that the question is implemented quite differently

point to the practical difficulties experienced when answering questions of this type (at least, but probably not only, in the German context):

Box 1: Interviewer note regarding the questionnaire item about years of education, German ESS questionnaire 2012

> Int.: Enter only full years (please round up or down accordingly). Example: If a training programme would have lasted one year full-time but it was completed as a part-time measure within two years, please count it as one year.
>
> This question refers to the entire duration of education and training of the respondent, including compulsory years of education or years at primary school. In the case of vocational education and training, include years with vocational school attendance. Include all (further) education and training measures completed at a secondary school, a higher education institution or other educational institution after the end of regular schooling.
>
> Do not include vocational education or training measures (e.g., internships, trainee programmes) without parallel attendance at a vocational school, *Fachhochschule*, *Hochschule*, or other educational institution!

In the ISSP, enterprise-based vocational training is excluded altogether because, for the ISSP, only full-time vocational education (without enterprise-based parts) counts. In the EQLS, only full-time education in general counts. Thus, vocational education and training and part-time education are not handled in a very uniform way. In the ISSP, repeated school years have been excluded since 2011; in the ESS, it appears as if they should be included, but an instruction to this effect is lacking.

3.2 Evaluation of the instruments for the measurement of years of education

3.2.1 Reliability

Despite the extensive interviewer instructions, there might be interpretation problems with regard to the question about years of education completed, for example because the question mentions *Berufsschule* (one specific type of vocational school in Germany, among others) or *Hochschule* but no other types of educational institution (e.g., *Berufsfachschule* or *Fachschule*). Whether all respondents interpret this in the same way – namely, that all vocational education institutions and not just *Berufsschulen* and *Hochschulen* are to be included in the calculation, and therefore answer the question in a reliable (reproducible) way is uncertain. The interviewer may have to help. Moreover, it is often unclear whether time spent in early childhood education (e.g., nursery school) is to be included, as the degree of formalisation of this level of education differs greatly across countries. None of the above-mentioned surveys provide instructions regarding the inclusion (or exclusion) of time taken to obtain a doctorate. Nor is it explained whether repeated school years should be included or not. Whether this is

in different countries. Input harmonisation has its limits, even in the case of the "simple" question about years of education.

meaningful depends on what exactly is to be measured: the individual investment of time in education and the duration of school socialisation (in that case, repeated years should be included) or the level of knowledge, competencies, and attitudes or other education and training goals attained (in that case, repeated years should be excluded; see also Helberger, 1988). And how should respondents who are still attending school answer this question? In the ESS, an instruction in this regard is lacking. In the ISSP, school years already completed are counted in the case of pupils. In the EQLS and the Eurobarometer, by contrast, a special code is assigned to pupils, which results in missing data. In the EVS (and the WVS), on the other hand, pupils are asked to report the age at which they *expect* to obtain their highest educational qualification. Maximum reliability might possibly be achieved by optimising the instructions. However, comprehensive instructions are themselves a problem because they are often not read by the interviewers and/or the respondents and they increase the complexity of the instrument.

Due to the typical complexity of educational careers nowadays, it is not even easy to measure this apparently simple indicator in a survey. It must be clear to the respondents which types of education are to be included and which are not (e.g., only school education or also early childhood education, vocational education and training, or higher education) and how they should report part-time education programmes or years of education that were begun but not completed, or repeated years of education. However, even then, rather low reliability is to be expected when measuring years of education. When one analyses the above questions and the corresponding response process from a cognitive psychology perspective, it soon becomes clear that random measurement errors are probable. Understanding the question and the target concept, retrieving the relevant information from memory, adding up the years spent in the various education programmes, and reporting of the answer for the questionnaire must all be considered difficult tasks.

For this reason, too, the duration of education is often derived from the highest educational qualification obtained and is not asked about directly in the survey (see Section 4.1.2). In the USA, the duration of education is sometimes measured with several questionnaire items by asking separately about the highest level successfully completed in different sectors of the education system (high school, college). Although this is quite time-consuming in differentiated education systems, it might allow the duration of education to be measured more reliably in European countries (Braun & Müller, 1997). It would also enable differentiated effects of the duration of education to be estimated by level (Goodman, 1979).

3.2.2 Validity

Section 2.3.1 already discussed difficulties experienced when the indicator *years of education* is chosen to measure educational attainment that may be due to the lack of fit between the theoretical concept and the empirical indicator. When measuring years of education, *systematic measurement errors* that impair validity are also probable. It is to be expected that errors that occur when measuring years of education are related to the construct to be measured – the level of education – because the cognitive competencies of more highly educated respondents make it easier to answer to the question. Moreover, depending on how much time has elapsed since the event and the relevance that the educational qualification still has for the individual at the time of the survey, the difficulty in retrieving the information from memory will differ among respondents (Campanelli & Channell, 1996). A further source of systematic measurement error, and thus insufficient validity, when measuring years of education is social desirability.

3.2.3 Comparability

The appeal of the indicator *years of education* is that it enables education to be measured in all countries and at all times in the same units (namely, years). Moreover, it is intuitively comparable across countries and over time, and the question itself can be translated from one language into other languages ("input harmonisation," see Hoffmeyer-Zlotnik, 2016). That also makes it attractive for measuring education in surveys of migrants. However, a criticism voiced with regard to the comparability of the indicator is that a year of education may be associated with very different learning intensity and quality (which may also be the case *within* a country). For example, whereas all-day schools are the norm in some countries, half-day schools (possibly with afternoon care and supervision) are the norm in others. If the validity of the indicator varies across countries (see Section 2.3.1 and Schneider 2010), this also negatively affects comparability.

3.2.4 Conclusion

Despite the many difficulties, the independent measurement of the duration of education as an *additional* indicator of the individual level of education is meaningful in principle as an auxiliary variable to scale education (see Section 4.1.2) or to enable random measurement errors to be corrected (see Section 4.1.4). The ESS, the ISSP, and the WVS all use an indicator of the duration of education in addition to the highest educational qualification in order to measure the respondent's level of education. However, it would be extremely useful if these instruments could be standardised and if translations and adaptations could be geared more towards international comparability.

3.3 Highest educational qualification

Especially in differentiated education systems, the most frequently used indicator of educational attainment is the highest educational qualification obtained (see Section 2.3.2). It is also the indicator that is recommended by international official statistical agencies (OECD & Eurostat, 2014). The measurement of the highest educational qualification requires country-specific measurement instruments. In the following sections, instruments capturing educational qualifications are illustrated using examples from Germany: first, the recommendation included in the German Demographic Standards (*Demographische Standards*, Hoffmeyer-Zlotnik et al., 2010), a set of exemplary socio-demographic survey questions developed by a working group comprising representatives from social research institutes, market research, and official statistics; second, the education items used by the German Microcensus, an official survey based on a 1 percent sample of the German population, which also forms the basis for the German contribution to the European Labour Force Survey.

In German surveys, following early recommendations (Müller, 1979), educational attainment is measured with two questions: one question about the highest general education school-leaving certificate obtained and one question about vocational education and training qualifications. The latter also include higher education degrees. The rationale behind this approach is as follows: First, it is known that, depending on the school leaving certificate held, the same vocational education and training qualification may have a different background and different implications. Second, the level of education successfully completed can be reliably allocated to international classifications of education only with a combination of these two questions (see Section 4.2). Third, two simpler items are preferable to one

complex item. Surveys for which education is a very important variable (e.g., SOEP, AES, and NEPS) often use more differentiated measurement instruments than those featured in the 2010 edition of the German Demographic Standards (Hoffmeyer-Zlotnik et al., 2010) and the German Microcensus, which are presented in what follows.

3.3.1 Educational qualifications in the German Demographic Standards

Figure 1 shows the questionnaire item about the highest general education school leaving certificate obtained, which appears in the current edition of the German Demographic Standards for face-to-face surveys (Hoffmeyer-Zlotnik et al., 2010).[7] Figure 2 shows the item about vocational education and training qualifications obtained. A slightly simplified variant of this item is used in the German General Social Survey (ALLBUS, see, e.g., the questionnaire from 2014). More detailed information about these instruments can be found in the Demographic Standards (Hoffmeyer-Zlotnik et al., 2010: 9–11).

Figure 1: Questionnaire item in the German Demographic Standards 2010 about the highest general education school leaving certificate obtained

5	**Welchen höchsten allgemeinbildenden Schulabschluss haben Sie?** **Sagen Sie es mir bitte anhand dieser Liste.** ***Liste „5" vorlegen!***		
	A Schüler/-in, besuche eine allgemeinbildende Vollzeitschule	( )	6
	B Von der Schule abgegangen ohne Hauptschulabschluss (Volksschulabschluss)	( )	7
	C Hauptschulabschluss (Volksschulabschluss)	( )	7
	D Realschulabschluss (Mittlere Reife)	( )	7
	E Polytechnische Oberschule der DDR mit Abschluss der 8. oder 9. Klasse	( )	7
	F Polytechnische Oberschule der DDR mit Abschluss der 10. Klasse	( )	7
	G Fachhochschulreife, Abschluss einer Fachoberschule	( )	7
	H Allgemeine oder fachgebundene Hochschulreife/Abitur (Gymnasium bzw. EOS, auch EOS mit Lehre)	( )	7
	I Abitur über zweiten Bildungsweg nachgeholt	( )	7
	J Einen anderen Schulabschluss,	( )	7
	und zwar: _____		

Note: Here is a partial translation into English. We have not attempted to translate the names of educational institutions, as names cannot be translated. For a detailed description of the German education system, see, for example, Schneider (2008a) and Hoffmeyer-Zlotnik and Warner (2014). Obviously, this translated version is for illustration purposes only and should not be used in an actual survey.

[7] A version has been proposed for telephone surveys (Hoffmeyer-Zlotnik et al., 2010, Chapter 3); the version for face-to-face surveys is also intended for use in written (postal) surveys (and presumably also in online surveys).

5 What is your highest general education school leaving certificate?
Please tell me with the help of this list.

Show List "5"!

A Student, I am attending a full-time general education school
B Left school without a *Hauptschule* leaving certificate (*Volksschule* leaving certificate)
C *Hauptschule* leaving certificate (*Volksschule* leaving certificate)
D *Realschule* leaving certificate (*Mittlere Reife*)
E *Polytechnische Oberschule* of the GDR with a leaving certificate from Grade 8 or Grade 9
F *Polytechnische Oberschule* of the GDR with a leaving certificate from Grade 10
G *Fachhochschulreife*, leaving certificate from a *Fachoberschule*
H General or subject-specific higher education entrance qualification/*Abitur* (*Gymnasium* or EOS, also EOS with apprenticeship)
I *Abitur* obtained through second-chance education
J Other school leaving certificate, namely: _____

By means of a filter, respondents who are still at school (response A) are asked a follow-up question about the school leaving certificate to which they aspire. This information is not needed for all surveys, because it may already be covered by another questionnaire item about the main activity. Moreover, this response category prevents a possibly already existing school leaving certificate from being collected from a respondent who is still at school. To avoid this, response categories A and B can be replaced by the response option "No school leaving certificate (yet)".

Similar to the school leaving certificates item, the item about vocational education and training qualifications (see Figure 2) includes two categories (A and B) for persons who are currently undergoing vocational education and training. Depending on the survey in question, these categories may be dispensable. In contrast to the item about the highest general education school leaving certificate obtained, the vocational qualification item takes the educational institution into account in the case of some of the vocational qualifications. Moreover, in the case of higher education degrees – with the exception of the Bachelor's degree – a distinction is made between university and *Fachhochschule*[8] degrees. On the other hand, the *Fachhochschule Diplom* and Master's degrees are grouped into one category although, in public service remuneration regulations for example, the *Diplom* is deemed to be the equivalent of a Bachelor's rather than a Master's degree.

[8] *Fachhochschulen* and other *Hochschulen* that do not have university status (i.e., cannot grant doctorates) often call themselves 'university of applied sciences' in English. We avoid this misleading translation here.

Figure 2: German Demographic Standards 2010 questionnaire item about vocational education and training qualifications

7	Welche beruflichen Ausbildungsabschlüsse haben Sie? Was alles auf dieser Liste trifft auf Sie zu? (Mehrfachnennungen möglich.) *Liste „7" vorlegen!* A Noch in beruflicher Ausbildung (Berufsvorbereitungsjahr, Auszubildende(r), Praktikant/-in, Student/-in) ( ) B Schüler/-in und besuche eine berufsorientierte Aufbau-, Fachschule o. Ä. ( ) C Keinen beruflichen Abschluss und bin nicht in beruflicher Ausbildung ( ) D Beruflich-betriebliche Berufsausbildung (Lehre) abgeschlossen ( ) E Beruflich-schulische Ausbildung (Berufsfachschule, Handelsschule, Vorbereitungsdienst für den mittleren Dienst in der öffentlichen Verwaltung) abgeschlossen ( ) F Ausbildung an einer Fachschule der DDR abgeschlossen ( ) G Ausbildung an einer Fach-, Meister-, Technikerschule, Berufs- oder Fachakademie abgeschlossen ( ) H Bachelor an (Fach-)Hochschule abgeschlossen ( ) I Fachhochschulabschluss (z. B. Diplom, Master) ( ) J Universitätsabschluss (z. B. Diplom, Magister, Staatsexamen, Master) ( ) K Promotion ( ) L Einen anderen beruflichen Abschluss, ( ) und zwar: _____	

Note: Here is a partial translation into English. We have not attempted to translate the names of educational institutions, as names cannot be translated. For a detailed description of the German education system, see, for example, Schneider (2008a) and Hoffmeyer-Zlotnik and Warner (2014). Obviously, this translated version is for illustration purposes only and should not be used in an actual survey.

7 What vocational qualifications do you have? Which of the items on this list apply to you? (Multiple responses allowed)

Show List "7"!

A Still undergoing vocational education and training (*Berufsvorbereitungsjahr*, apprentice/trainee, intern, student)
B Student attending a vocationally-oriented *Aufbauschule*, *Fachschule*, or the like
C No vocational qualification and not undergoing vocational education and training
D School- and enterprise-based vocational education training within the dual system (apprenticeship) successfully completed
E School-based vocational education and training (*Berufsfachschule*, *Handelsschule*, preparatory service for the intermediate service in public administration) successfully completed

F	Vocational education and training at a *Fachschule* in the GDR successfully completed
G	Vocational education at a *Fachschule*, *Meisterschule*, *Technikerschule*, *Berufsakademie*, or *Fachakademie* successfully completed
H	Bachelor's degree at a university or *Fachhochschule* successfully completed
I	Degree from a *Fachhochschule* (e.g., *Diplom*, Master's)
J	University degree (e.g., *Diplom*, *Magister*, *Staatsexamen*)
K	Doctorate
L	Another vocational qualification, namely: _____

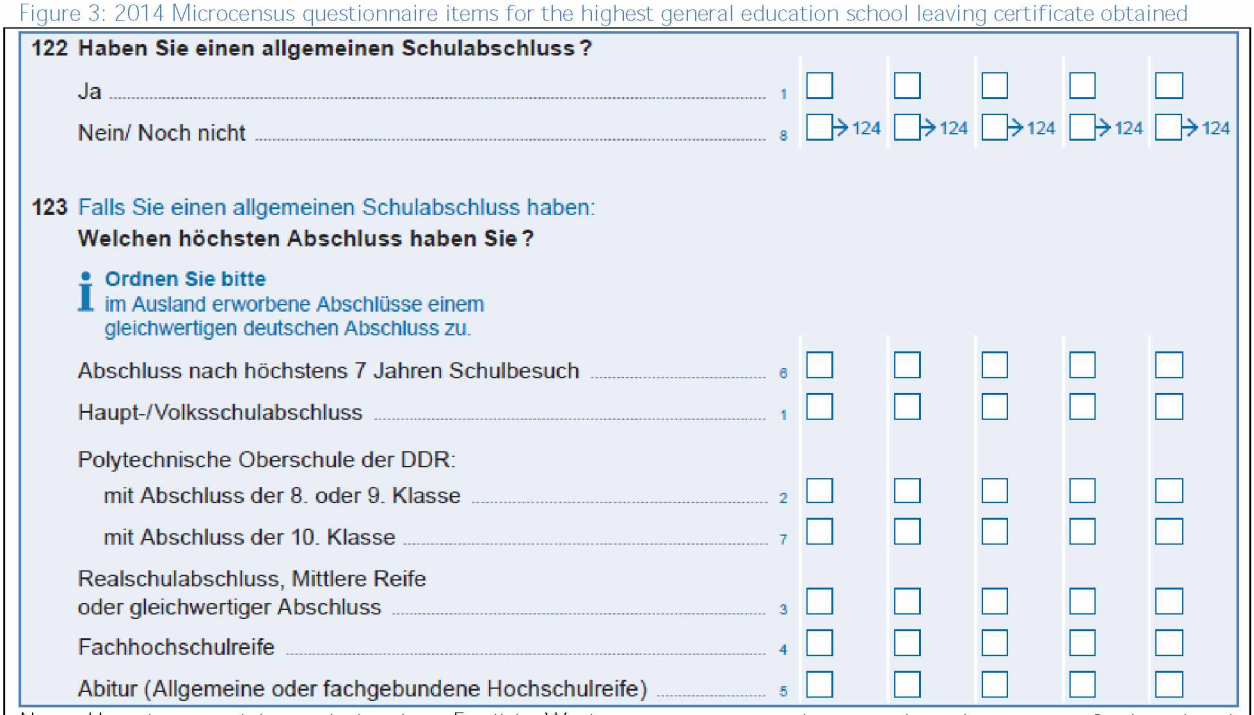
The German Demographic Standards (and the ALLBUS) provide not only for the measurement of the highest vocational qualification but also allow multiple responses. Depending on the epistemic interest, this may be dispensable. However, it is meaningful in situations where respondents are unsure which of their qualifications is the highest. Moreover, especially in self-administered questionnaires, respondents sometimes use the "other" category to report several qualifications. The subsequent coding of these data requires additional effort. And finally, the response options can be understood ordinally only in part. The questionnaire of the German sub-survey of the ESS steers a middle course by asking for the highest vocational education and training qualification and the highest higher education qualification separately (European Social Survey, 2012b). In this way, the multiple response option can be dispensed with without the risk of losing valuable information about whether someone has successful completed vocational education and training and a university degree. As a result, higher education degrees can be differentiated more in the ESS in order to capture institutional differences (especially between universities and *Fachhochschulen*). For the respondents, the distinction between vocational education and training qualifications and higher education degrees appears to be quite challenging, as the use of the "other" category in these questions shows. For example, many respondents report their higher education degree once again in the question about their highest vocational education and training qualification, although it was already asked about in the previous question. Here, the instructions have been further refined for ESS Round 8, which will be fielded in autumn 2016.

Vocational qualifications obtained abroad can either be allocated to the German categories, which is likely to be a difficult task for the interviewers and the respondents, or they can be openly recorded via response categories J and L. This results in extra costs for subsequent coding. Coding is also difficult in the case of qualifications obtained abroad. In the case of the general educational school item, leaving certificates from special needs schools or Waldorf schools (also known as Steiner schools) are often reported, for which separate categories are not provided.

3.3.2 Educational qualifications in the German Microcensus questionnaire

The questionnaire of the 2014 Microcensus is more up to date than the German Demographic Standards because all European countries are obliged to implement ISCED 2011 in their labour force surveys. Moreover, due to the use of filter questions, the design differs somewhat from that of the Demographic Standards. For this reason, the relevant instruments from the 2014 Microcensus questionnaire (Statistische Ämter des Bundes und der Länder, 2014) will be presented in what follows. Figure 3 shows the items for general education school leaving certificates, while Figure 4 shows the items for vocational qualifications.

Figure 3: 2014 Microcensus questionnaire items for the highest general education school leaving certificate obtained



122 Haben Sie einen allgemeinen Schulabschluss?

Ja	1	☐	☐	☐	☐	☐
Nein/ Noch nicht	8	☐→124	☐→124	☐→124	☐→124	☐→124

123 Falls Sie einen allgemeinen Schulabschluss haben:
Welchen höchsten Abschluss haben Sie?

Ordnen Sie bitte
im Ausland erworbene Abschlüsse einem gleichwertigen deutschen Abschluss zu.

Abschluss nach höchstens 7 Jahren Schulbesuch	6	☐	☐	☐	☐	☐
Haupt-/Volksschulabschluss	1	☐	☐	☐	☐	☐
Polytechnische Oberschule der DDR:						
mit Abschluss der 8. oder 9. Klasse	2	☐	☐	☐	☐	☐
mit Abschluss der 10. Klasse	7	☐	☐	☐	☐	☐
Realschulabschluss, Mittlere Reife oder gleichwertiger Abschluss	3	☐	☐	☐	☐	☐
Fachhochschulreife	4	☐	☐	☐	☐	☐
Abitur (Allgemeine oder fachgebundene Hochschulreife)	5	☐	☐	☐	☐	☐

Note: Here is a partial translation into English. We have not attempted to translate the names of educational institutions, as names cannot be translated. For a detailed description of the German education system, see, for example, Schneider (2008a) and Hoffmeyer-Zlotnik and Warner (2014). Obviously, this translated version is for illustration purposes only and should not be used in an actual survey.

122 Do you have a general school leaving certificate?
Yes
No / Not yet

123 If you have a general education school leaving certificate:
What is your highest school leaving certificate?
Please assign
qualifications obtained abroad to an equivalent German leaving certificate
Leaving certificate after not more than 7 years school attendance
Hauptschule/*Volksschule* leaving certificate
Polytechnische Oberschule in the GDR
with a leaving certificate from Grade 8 or 9
with a leaving certificate from Grade 10
Realschule leaving certificate, *Mittlere Reife* or equivalent leaving certificate
Fachhochschulreife
Abitur (general or subject-specific higher education entrance qualification)

The designations of the categories differ slightly from those in the Demographic Standards, and the layout is adapted to self-administered questionnaires. The response option "Leaving certificate after not more than 7 years school attendance" has no equivalent in the Demographic Standards. According to the Interviewer Handbook, this category is intended not only for respondents who obtained their educational qualification abroad and whose school leaving certificate is lower than the lowest German school leaving certificate (i.e., the *Hauptschule* leaving certificate) but also for graduates of special needs schools who do not have a *Hauptschule* or a *Realschule* leaving certificate (Statistische Ämter

des Bundes und der Länder, 2011: 49), although they will usually have completed more than 7 years of schooling.

Figure 4: 2014 Microcensus questionnaire items about the highest vocational qualification obtained

124 Haben Sie einen beruflichen Ausbildungsabschluss oder einen Hochschul-/Fachhochschulabschluss?

Als berufliche Ausbildung gilt auch eine Anlernausbildung oder ein Praktikum von mindestens 12 Monaten.

Ja ..... 1 ☐ ☐ ☐ ☐ ☐

Nein/ Noch nicht ..... 8 ☐→132 ☐→132 ☐→132 ☐→132 ☐→132

124 Do you have a vocational qualification or a degree from a university or *Fachhochschule*?
An *Anlernausbildung* or an internship of at least 12 months duration also counts as vocational training
Yes
No/Not yet

125 Falls Sie einen beruflichen Ausbildungs- oder Hochschul-/Fachhochschulabschluss haben: Welchen höchsten Abschluss haben Sie?

Ordnen Sie bitte im Ausland erworbene Abschlüsse einem gleichwertigen deutschen Abschluss zu.

Ziffer aus der Liste 9 ..... ☐☐ ☐☐ ☐☐ ☐☐ ☐☐

Liste 9

Beruflicher Ausbildungsabschluss

Anlernausbildung, berufliches Praktikum 01
Berufsvorbereitungsjahr 02
Lehre, Berufsausbildung im dualen System 03
Berufsqualifizierender Abschluss an einer Berufsfachschule, Kollegschule 04
Vorbereitungsdienst für den mittleren Dienst in der öffentlichen Verwaltung 05
Ausbildungsstätten/Schulen für Gesundheits- und Sozialberufe:
einjährig (z. B. Krankenpflegehelfer/-in, Altenpflegehelfer/-in, Rettungsassistent/-in) 06
zweijährig (z. B. Masseur/-in, Medizinischer/ Medizinische Bademeister/-in, PTA, Podologe/ Podologin) 07
dreijährig (z. B. Physiotherapie, Gesundheits- und Krankenpflege, MTA, Altenpflege) 16
Ausbildungsstätten/Schulen für Erzieher/-innen 17
Meister/-in, Techniker/-in oder gleichwertiger Fachschulabschluss 08
Fachschule der DDR 09
Fachakademie (nur in Bayern) 10

Hochschulen/Fachhochschulen

Diplom, Bachelor, Master, Magister, Staatsprüfung, Lehramtsprüfung:
Berufsakademie 11
Verwaltungsfachhochschule 12
Fachhochschule (auch Ingenieurschule, Hochschule (FH) für angewandte Wissenschaften), Duale Hochschule Baden-Württemberg 13
Universität (wissenschaftliche Hochschule, auch: Kunsthochschule, Pädagogische Hochschule, Theologische Hochschule) 14
Promotion 15

125 If you have a vocational qualification or a university/*Fachhochschule* degree:
What is your highest qualification?
Please assign qualifications obtained abroad to an equivalent German qualification
Code from List 9 — — — — —
List 9

Vocational qualification
Anlernausbildung, internship 01
Berufsvorbereitungsjahr 02
Apprenticeship, vocational education and training within the dual system (school- and work-based) 03
Vocational qualification obtained at a *Berufsfachschule, Kollegschule* 04
Preparatory service for the intermediate level in public administration 05

Vocational schools for occupations in the health and social sectors:
one-year (e.g., nursing/geriatric nursing assistant, paramedic) 06
two-year (e.g., masseur, medical bath attendant, pharmaceutical assistant (PTA), podologist) 07
three-year (e.g. physiotherapist, health care, nursing, medical technician, geriatric nursing) 16
Fachschule for early childhood educators 17
Meister, Techniker or equivalent *Fachschule* qualification 08
Fachschule in the GDR 09
Fachakademie (only in Bavaria) 10
Universities/Fachhochschulen
Diplom, Bachelor's, Master's, Magister, Staatsexamen, Lehramtsprüfung
Berufsakademie 11
Verwaltungsfachhochschule 12
Fachhochschule (incl. *Ingenieurschule*),
Duale Hochschule Baden-Württemberg 13
University (academic higher education, incl. college of art, college of education, theological college 14
Doctorate 15

130 Falls Sie einen Hochschul-/Fachhochschulabschluss haben:
Wie ist die Bezeichnung Ihres höchsten Abschlusses?

Bachelor	1	☐	☐	☐	☐	☐
Master	2	☐	☐	☐	☐	☐
Diplom, Lehramtsprüfung, Staatsprüfung, Magister, künstlerischer Abschluss und vergleichbare Abschlüsse	3	☐	☐	☐	☐	☐

130 If you have a university/*Fachhochschule* degree:
What is the designation of your highest degree?
Bachelor's
Master's
Diplom, Lehramtsprüfung, Staatsexamen, Magister, arts degree and equivalent qualifications

Note: The translation into English are partial only. We have not attempted to translate the names of educational institutions, as names cannot be translated. For a detailed description of the German education system, see, for example, Schneider (2008a) and Hoffmeyer-Zlotnik and Warner (2014). Obviously, this translated version is for illustration purposes only and should not be used in an actual survey.

Besides the fact that the Microcensus uses filter questions that save respondents who do not (yet) have a qualification from having to read quite lengthy lists of response options, what is striking about this survey is that it does not ask for all vocational qualifications but only for the highest vocational qualification, which is collected in a more differentiated way than suggested in the Demographic Standards. For example, the *Fachschule* for early childhood educators is separated from other *Fachschule* training programmes, and health sector schools are taken into account in three categories. Moreover, pre-vocational training measures are collected, even though they do not yet lead to a labour-market relevant vocational qualification. However, this approach may possibly make it easier for respondents to correctly identify vocational qualifications from *Berufsfachschulen*. The differentiation of the higher education sector by level and institution is also more pronounced than in the Demographic Standards. This is achieved by the subsequent item 130, whereby first the horizontal differentiation (type of higher education institution) and then the level of education (type of degree) is asked for. ALLBUS takes a similar approach (Item F020A in the questionnaire of the ALLBUS 2014). In the case of persons with a higher education degree, a later question records whether they also have a vocational education and training qualification, so that, as in the ESS, the absence of a multiple-response option is compensated to a certain extent.

3.4 Evaluation of the instruments for the measurement of educational qualifications

3.4.1 Reliability

For most respondents, the question about the highest educational qualification is easier to answer than that about the cumulative duration of education. This is because, in most cases, the successful completion of an education programme is a biographically decisive event, and all that has to be retrieved from memory is the information about the highest qualification rather than the entire educational career. This should (theoretically) lead to a higher reliability of the responses.

Assessment of the reliability of the instruments for the measurement of educational qualifications is difficult because tests of reliability (e.g., by means of repeat measurements) are rarely conducted for demographic variables. A test-retest study of the 1984 ALLBUS (Porst & Zeifang, 1987), which was conducted almost three decades ago, revealed quite high stability in the case of the (then used) item about general school education (89% agreement over three waves) but, as Porst and Zeifang put it, only "just about acceptable" stability in the case of the vocational education item (72%). In those days, the vocational education measure had only eight response categories. A methodological analysis and empirical evaluation of the measurement instruments on the basis of the Microcensus panel 2001-2004 can be found in Schimpl-Neimanns (2013). Low consistency values across Microcensus waves were observed in the case of general education school leaving certificates for the categories "no certificate" and *Fachhochschulreife* (*Fachhochschule* entrance qualification). In the case of vocational qualifications, all qualifications apart from apprenticeships and university degrees were affected by high inconsistency. The categories "semi-skilled training/internship" (01), *Berufsvorbereitungsjahr* (one year of pre-vocational training for students who do not hold a *Hauptschule* leaving certificate) (02) and "vocational qualification from a *Berufsfachschule*" (04) scored particularly poorly. Respondents were especially unsure which of the categories provided they should allocate their vocational qualifications to, and they therefore chose different – albeit adjacent – response categories from wave to wave. Inconsistencies were even more pronounced among migrants. Schimpl-Neimanns therefore recommended thorough pretesting to improve the response categories – a recommendation that one cannot but endorse.

3.4.2 Validity

The theoretical appropriateness of the indicator *highest educational qualification* has already been discussed in Section 2.3.2. In what follows, this will be supplemented with a discussion of the completeness and the degree of differentiation of the response categories, which decisively influences the validity of the measurement instrument. The completeness and comprehensibility of the response categories can be considered good when only a few respondents choose the "other qualification" category and when the reported qualification corresponds to person's actual highest qualification. In the case of the general education school leaving certificate item, this is quite easy to ensure, whereas in the case of the vocational qualifications item, it is much more difficult, as the considerable differences between the Demographic Standards and the Microcensus show.

It is not always easy to report educational qualifications in questionnaires because, in order to prevent the list from becoming too long and confusing, the response categories are often abstractions from, and summaries, of concrete educational qualifications. The most common qualifications should be ex-

plicitly named, so that the majority of respondents can assign themselves to the correct category with ease. However, as a result of the increasing differentiation of education systems and the proliferation of possible qualifications, it must be assumed that the group of respondents who have difficulties assigning their qualifications will grow over time. Müller's (1979) suggestion that separate lists of categories should be developed for different age groups, for example, has not been followed to date. The federal nature of the German education system is particularly problematic in this context, as is the increasing importance of schools that provide several education programmes (e.g., *Werkrealschule*, *Mittelschule*, *Stadtteilschule*, *Regionale Schule*, *Oberschule*, *Sekundarschule*, and *Regelschule*). Not only are equivalent school types designated differently in different federal states, but also the qualifications that can be obtained in these schools. They are not all mentioned in the response categories in the hope that all respondents will be familiar with the traditional designations *Hauptschule* leaving certificate and *Realschule* leaving certificate. However, it is difficult to say whether all those who hold *a mittlerer Bildungsabschluss* (intermediate certificate) will actually allocate it to the *Realschule* leaving certificate category.

The required extent of the differentiation can be tested on the basis of validation studies in which the predictive power of strongly differentiated and hardly differentiated variables is compared (see e.g. Müller & Klein, 2008; Schneider, 2010). However, this presupposes differentiated survey measurement because, if an important differentiation is not taken into account in the measurement, it cannot be analysed. Conversely, empirical decisions that later prove to be irrelevant for a certain research question can easily be reversed at the coding stage (see Section 4.2.6). This is also an argument in favour of differentiated measurement at the data collection stage. In the case of the vocational education item, it is striking that the differentiation between industrial, agricultural, and commercial apprenticeships, which is made in the ALLBUS and in the ESS, is not provided for in the Demographic Standards or the German Microcensus. However, a commercial apprenticeship, which prepares for service and administrative occupations, leads to a higher income than an industrial apprenticeship, which prepares for manual occupations (see, e.g., Helberger, 1988). .

As in the case of years of education, it must be assumed that errors in the measurement of educational qualifications are linked to the level of education itself, the respondent's age, and the relevance of the educational qualification for the respondent (see Section 3.2.2). Social desirability may be more pronounced than in the case of years of education. This may manifest itself in the fact that educational programmes that the respondent withdrew from (i.e., dropped out of) may be reported as successfully completed, that the qualification currently typically required for the respondent's occupation is reported, or that, in case of doubt, the higher of two plausible categories is chosen.

In contrast to years of education, changes in the education system often render it necessary to adapt the instrument used to measure educational qualifications. The more generic (and thus the less valid) the measurement instrument is, the less need there is to adapt it to reflect changes in the education system. Because of their low validity, highly generic measurement instruments are not to be recommended. However, because of future educational reforms, specific instruments that establish concrete links to the education system cannot be standardised once and for all. Hence, there is a conflict of objectives here between validity and standardisation.

3.4.3 Comparability

As Hoffmeyer-Zlotnik et al. (2010: 5) pointed out, the German Demographic Standards should be handled flexibly because different topics of investigation and different thematic focuses call for different levels of differentiation in the measurement of demographic variables. This applies also to the degree of differentiation of the response categories. As a result, the aspiration to standardisation and the comparability across studies is lost or can be established only by aggregating data to the lowest common denominator with corresponding losses of information. It is therefore advisable to retain the differentiation of the proposed response categories.

The question of cross-national comparability is more complicated. National education systems have developed very differently over time, and each system has its own idiosyncratic institutions. Respondents think in terms of these institutions, so that educational qualifications must be collected with country-specific measurement instruments. The designations of educational qualifications cannot be meaningfully translated from one language to another, even though they sometimes sound quite similar (e.g., the French *Baccalauréat*, the Spanish *Bachillerato,* and the Bachelor's degree). Therefore, this indicator is not directly comparable across countries. Instead, the qualifications must be allocated to comparable categories or scales ("harmonised") with the help of an international classification (see Chapter 4).

The instruments for the measurement of educational qualifications must therefore be designed in such a way that international standard variables can be derived from them (see Section 4.2).[9] It is useful to work backwards, so to speak, from the target international education variable. If one does that for the items presented above, one notices that the general education school leaving certificate item in the Demographic Standards does not allow ISCED level 0 (no level of education successfully completed) and ISCED level 1 (primary education successfully completed) to be distinguished. Both groups are very small in Germany, and are not considered separately for national purposes, but if the differentiation is not made in Germany, it is also lost in the countries in which it is important as soon as their data are pooled with the German data. Successfully completed educational programmes for which no qualification is awarded but which constitute an education level (e.g., primary school in Germany) should therefore be treated as if they were an educational qualification (OECD & Eurostat, 2014). For that reason, too, the new response category in the Microcensus, "Leaving certificate after not more than 7 years school attendance" is to be welcomed. On the other hand, the distinction between the *Abitur* (general higher education entrance qualification) obtained via first- or second-chance education can be dispensed with in principle. Contrary to what is stated in the Demographic Standards, this information is not required to code the qualification into ISCED (see Section 4.2.3), as ISCED level 4 can be derived just as well from the combination of *Abitur* and vocational education and training because, to obtain the *Abitur* via second-chance education, the individual must already have a vocational qualification.

The question of comparability arises not only in the case of cross-national comparative research. As Müller (1979) already noted in the late 1970s, education systems have undergone considerable differ-

[9] The adaptation of the Demographic Standards to ISCED 2011 is still in progress. This adaptation is necessary in order to enable the new differentiations in the higher education sector to be taken into account. The revised Demographic Standards are scheduled for publication in 2016.

entiation in the course of educational expansion. Whereas in the old days there was only a handful of educational institutions and a modest number of educational programmes and qualifications, nowadays we are confronted with an almost unmanageable level of institutional diversity. In federally organised countries, such as Germany, this complexity is particularly pronounced because the school types and qualifications are not uniformly labelled across federal states. Educational reforms and federal structures lead to situations where respondents in surveys of the adult population have obtained their education in different systems – even within the same federal state. The measurement instruments must therefore also cover outdated qualifications and regional variants, and they must do so without overtaxing the respondents. In the case of Germany, this means that GDR qualifications must be collected if the sample contains persons who completed their education and training before 1990. This is usually done by extending the response categories accordingly. Alternatively, respondents can first be asked in what country – the FRG, the GDR, abroad – they obtained their qualification and they can then be shown a suitable (and shorter) list of response categories. However, this is practised only in a few surveys (e.g., as a pilot study in the IAB/ SOEP Migrant Sample 2016, Brücker et al., 2014) although it could be a meaningful solution especially when surveying migrants.

A further difficulty is the measurement of migrants' educational qualifications. To date, the "import" through migration or student mobility of educational qualifications obtained abroad has hardly been taken into account at all in the measurement of education. Hence, respondents (and interviewers) are usually expected to allocate qualifications obtained abroad to an "equivalent" German qualification (see, e.g., Statistische Ämter des Bundes und der Länder, 2011). For want of alternatives, this approach is also supported by official statistical agencies (OECD & Eurostat, 2014: 11). The fact that the qualification in question was obtained abroad is not usually recorded (exception: PIAAC questionnaire 2012). Nor is it recorded whether the qualification has been recognised by the national authorities. It is unclear whether the allocation of qualifications obtained abroad to similar German qualifications succeeds adequately. Alternatively, provision is made for an open-ended response category for "other qualifications". However, no recommendations are available for the further processing of the resulting data. As envisaged by the OECD and Eurostat, integrated ISCED mappings of different countries might be used in future to enable qualifications obtained abroad to be correctly measured and classified (OECD & Eurostat, 2014: 11). Work is in progress on the development of a corresponding software tool and a database for use in computer-assisted surveys.[10]

3.4.4 Conclusion

In summary, it can be stated that there is no alternative to the measurement of educational qualifications – not least because several codifications for education can be derived from it. To a large extent, existing questionnaire items can be used. However, if possible these items should be tested and optimised more regularly – also for different survey modes – and interviewers should be given appropriate training. For cross-national comparative studies, the instruments developed within the framework of the ESS [11] can often be used (see also Section 4.2.4).

[10] http://www.gesis.org/en/research/external-funding-projects/projektuebersicht-drittmittel/camces/
[11] http://www.europeansocialsurvey.org/docs/round6/survey/ESS6_appendix_a1_e02_0.pdf

4 Coding educational attainment in survey data

In statistical analyses, variables can rarely be used in the form in which they were collected. They are usually recoded in order to tailor the analyses to the specific hypotheses and possibly to simplify them. Depending on the theoretical concept and indicator chosen (see Chapter 2), the coding of education may be interval-scaled (years of education), ordinal-scaled (positional measures of education), or nominal-scaled (educational transitions and educational qualifications). In the present chapter, the main approaches to coding education in national and cross-national comparative surveys are summarised.

In intercultural studies – be they cross-national comparative surveys or surveys of migrants – country-specific education variables must be processed further after measurement in order to enable a joint analysis of all countries or groups of persons. This process is referred to as *ex ante output harmonisation* (Ehling, 2003; Granda, Wolf, & Hadorn, 2010). It entails recoding country-specific variables into a new, cross-nationally comparative variable. Academic social researchers and statistical agencies have developed different solutions in this regard. These solutions, and their strengths and weaknesses, will also be briefly described in the present chapter.

For country-specific multivariate analyses, there is no "standard coding" of education for Germany. However, examples can be found in the German Education Report (Hasselborn et al., 2014). The codes developed for cross-national comparative survey research can, of course, be applied to German samples. However, especially in the case of years of education (see Section 4.1.1) and nominal codings (see Section 4.2), the national distinctions that may be lost during coding must be considered. If the data of only one country are fed into the analysis, or, in the case of cross-national comparative analyses, if country-by-country (instead of pooled) models are estimated and education is used only as a control variable, the best country-specific education variable available should therefore be used because its measurement quality is (almost) always higher than that of harmonised variables (Braun & Müller, 1997).

4.1 Coding education into an interval-scaled or ordinal-scaled variable

Different ways of coding education into an interval-scaled or ordinal-scaled variable in order to measure it linearly or positionally are presented in what follows (see Sections 2.3.1 and 2.3.3). The resulting variables can be centred (also for certain comparison groups) in order to measure deviations from the mean. If education is an independent variable, the intercept can thus be interpreted as the mean value of the dependent variable for individuals with average education.

4.1.1 Actual years of education

The simplest continuous coding entails allocating individuals their respective actual number of years of education (see Section 3.1). When doing so, extreme values are usually "trimmed," that is, assigned the highest or lowest plausible value. For reasons set out earlier (see Sections 2.3.1 and 3.2), the actual duration of education is practically never used – or practically never used on its own. Instead, as explained in Section 4.1.3, if the duration of education is required, it is derived from educational qualifications (Helberger, 1988).

4.1.2 Univariate positional measures of education

Positional measures of education (in the narrow, i.e. univariate, sense) can be developed in various ways, and there is no established "one best way" (Bukodi & Goldthorpe, 2016; Triventi et al., 2016). What all the methods have in common is that the absolute distribution of education is mathematically transformed, and that this is carried out within a relevant social comparison group, for example of countries (and possibly regions) and/or educational cohorts. In contrast to bivariate or multivariate scaling (see Sections 4.1.3 and 4.1.4), only the information about the education of the individual him- or herself is used (and not, in addition, information about his or her social status or the education of parents and/or spouse or partner).

Transformation options include ranking individuals according to their years of education and/or educational qualifications, the standardisation of years of education, and the creation of percentile scores (Bol, 2015; Ultee, 1980; Wolbers et al., 2001). The latter express the proportion of a comparison group that has attained at least the same level of education and thus potentially competes for jobs at a comparable level. Hence, the results can be interpreted in percent. Tam (2005, unpublished) developed the "Positional Status Index" (PSI), which is calculated as the ratio of the proportion of the population below and above a certain level of education. It was applied, for example by Rotman et al. (2016) and Triventi et al. (2016). Moreover, Triventi et al. (2015) developed a similarly constructed "Educational Comparative Advantage Index". The correlation between the two indices is 0.98. What all these approaches have in common is that the information on the specific educational category – and thus also its signal character – is lost through transformation. Therefore, Bukodi and Goldthorpe (2016) chose another approach – namely, they grouped educational qualifications together ordinally in such a way that the categories in all cohorts were equally large.

Although positional measures of education correlate highly with absolute measures of education – at least when the latter are measured in years and the positional measure is derived from years of education (Bol, 2015; Triventi et al., 2016), they may have different effects: Bukodi and Goldthorpe (2016) compared in separate models absolute and relative measures of education that were derived from categories of educational qualifications. When an absolute measure of education was used, a weakening of the determination of educational attainment by the social class of the father was observed, whereas when a relative measure was used, educational inequality remained stable across cohorts. Rotman et al. (2015) also observed differences in Israel. However, they found that inequality of educational opportunities tended to persist or decline when absolute measures of educational attainment was used and it tended to *increase* when educational attainment was measured in relative terms. For Italy, by contrast, no differences were observed between positional and absolute measures of education, although years of education rather than educational qualifications was used in both cases (Triventi et al., 2015).

Especially in differentiated education systems, the hierarchy of qualifications is not always unequivocal, and, depending on the context under consideration, it can also change. Education is often measured too crudely, with the result that it is not possible to create meaningful percentile scores or other position indices. Clustering is a familiar problem when developing relative measures of education. Moreover, it is still unclear how exactly such measures can be used for cross-national comparative studies on educational inequality, because it has not yet been tried.

4.1.3 Hypothetical years of education and bivariate scaling of educational qualifications

There are different ways of scaling education, whereby educational qualifications are quantified by means of an interval-scaled auxiliary variable. This may be useful, especially for the assessment of the socio-structural significance or the value of qualifications in the labour market over longer periods of time and across countries, and it is often used as an operationalisation of a relative concept of education (see, e.g., Rotman et al., 2015). At the same time, these codings enable education to be linearly modelled in the data analysis. However, there is no longer a direct link to specific educational categories, which, depending on the theoretical interest, may, or may not, be meaningful.

The simplest type of scaling entails assigning to each educational qualification a hypothetical number of years of education required to obtain it. In the case of Germany, either the years of education of specific combinations of general school education and vocational education and training can be directly coded, or each school and vocational education qualification can be assigned the respective number of years of education, which are then added up to a total duration of education (see Helberger, 1988: 154). Sometimes, deductions are made for vocational education and training qualifications because they lead to a lower status and income growth than general education qualifications of the same duration (Ganzeboom & Treiman, 1993). In the case of part-time education and training, the duration is taken into account in full-time equivalents – that is, only partly. This process has hardly been standardised to date because, firstly, the starting categories differ from survey to survey (see Section 3.3), secondly, the duration of the related education programmes is not documented in a clear and concise way (however, see the "education recodes" in Ganzeboom & Treiman, 2012 and the overview in Helberger, 1988, Table 1), and thirdly, different authors have different thematic focuses. Moreover, Helberger (1988) drew attention to the heterogeneity of the time needed to obtain nominally identical qualifications. For example, an apprenticeship may last between two and four years, and under certain circumstances the duration can be reduced by up to a year. Cohort differences are not usually taken into account, either, although the number of years required to obtain specific qualifications changes over time due to educational reforms. However, the effects of extending the duration of compulsory education in Germany from 8 to 9 years, the reduced duration of apprenticeships in the case of those who hold a higher education entrance qualification (*Abitur*), and the differing duration of higher education depending on the field of study, do not appear to be empirically substantial (Helberger, 1988).

A further way of coding education linearly is to scale it with the help of a second variable that correlates highly with education and that is at least implicitly hierarchical. Hoffmeyer-Zlotnik and Warner (2007) scaled education in a matrix along two dimensions of general school education and vocational education and training (including higher education) for three countries (Denmark, Germany, and Luxembourg). Depending on the respective combination of general and vocational qualifications, each individual was assigned a value between 1 and 10 that ordinally represented the occupational prestige (following Treiman, 1977) that could typically be achieved with that combination. However, the documentation of the process of allocating values to the matrix was not sufficiently detailed to enable it to be applied to other countries. Moreover, this approach may not work well for countries in which vocational education is closely interwoven with general education, thereby rendering the construction of the matrix problematic. In contrast to common practice in Germany, general school education qualifications and vocational education and training qualifications are not measured with two separate questionnaire items in most countries (see Section 3.3).

The process of scaling can be automated by using suitable auxiliary variables if they are available in the data. This entails computing (where appropriate by country and educational cohort) the mean value of the scaling variables for each category of educational qualifications and assigning this value to all individuals in that category. To overcome the above-mentioned weakness of hypothetical years of education, the *actual* duration of education can be used for scaling purposes. Of course, this works only if years of education and educational qualifications have been measured separately (as is the case in the ESS and the ISSP, for example). The result is group-related *typical* years of education for a specific qualification. Instead of using the "input," for example years of education or the occupational status of the parents, to scale education, one can use the "output," for example social status or occupational prestige (Treiman & Terrell, 1975; Triventi et al., 2015) or income (Rotman et al., 2015). The conditional mean occupational prestige (or income) value is then assigned to each educational category. This is referred to as *effect-proportional scaling*. In the case of ordinal or categorical scaling variables, log-linear and log-multiplicative models can be used (Smith & Garnier, 1987).

The result is an education scale that can be modelled linearly and that expresses the different "value" of specific qualifications. It thus corresponds to a bivariate-positional concept of education (see Section 2.1.3). The correlation between the scale and the scaling variables is maximised through this procedure and – at least with regard to the chosen criterion – no information is lost. Scaling enables the variance of education to be preserved, which often does not succeed in the case of nominal codings (see Section 4.2) because the resulting information is too coarse-grained. Scaled variables are therefore also suitable for use as control variables because the specific educational categories are not important and no information is lost.

How successful the scaling of education is in practice depends on the level of differentiation of the initial measurement of educational qualifications (see Section 3.3) and the extent to which the scaling variable is scattered around the mean value within each education category, which is incorporated into the new education variable and is thus possibly group-specific. Moreover, a scaled education variable is no longer a pure education variable because it expresses education in the "currency" of another, quantitative, variable, as it were. Thus, the comparability problem shifts to this other variable and, in the case of differences over time or across countries, it is unclear whether they are due to changes in education, to the scaling variable, or the relationship between the two (Braun & Müller, 1997). Finally, effect-proportional scaling leads to different scales across studies and scaling variables, with the result that they are hardly comparable across studies.

4.1.4 Multivariate scaling: Education as a latent variable

Indicators that are measured with only a single questionnaire item produce conservative estimators, that is, they tend to underestimate the associations with other variables. This is due to the presence of random measurement errors that result in an increase in variation around the mean value without distorting the mean value itself. These errors occur in every measurement process – even in the case of apparently simple demographic variables. Education scores that are derived from multivariate analyses perform better. Here, education measured with several indicators is statistically modelled as a latent variable. In this way, random measurement errors can be identified and statistically corrected (see, in particular, Schröder & Ganzeboom, 2013). In this case, too, the result is a linear education variable.

To be able to implement such an approach, education must be measured with several questionnaire items. However, in the case of education, the development of multiple indicators is quite difficult. For how can a specific educational qualification be measured with different instruments without confusing the respondent? Schröder and Ganzeboom (2013) rely, in addition, on the educational qualifications and years of education of the respondent's parents and spouse or partner (if there is one). Similarly to the indices of social background or socio-economic status comprising several correlating variables, in which occupation, education and often other variables of the respondent and/or his or her parents are combined to form a new variable (Hauser & Warren, 1997; Marks, 2011), it is no longer quite clear what is actually being measured – the respondent's education or the educational resources of the whole family? Moreover, the scores can hardly be abstracted from the model within which they were calculated. For that reason, few attempts have been made to analyse educational inequality or returns to education on the basis of structural equation models or latent class models.

4.2 Nominal coding of educational qualifications

Nominal or categorical codings of education are chosen when the underlying education concept is multi-dimensional, or when specific educational categories or levels (e.g., higher education) are of essential interest for the research question (see Section 2.3.2). The level of education successfully completed can be coded very comprehensively with categorical variables because both vertical and horizontal differentiations can be captured. The most well-known are two systems designed for the purpose of cross-national comparison: CASMIN (see Section 4.2.2) and ISCED (see Section 4.2.3). Many countries have also developed national classifications of education (e.g., the *Standaard Onderwijsindeling* [SOI] in the Netherlands, Centraal Bureau voor de Statistiek, 2015). However, scientists often code education variables in a theory-driven way or ad hoc for their specific research questions.

4.2.1 Binary coding of education

In the simplest case, education is sequential-binary coded in order to investigate cumulative educational transitions. Dichotomous variables – which play a major role especially in research on education transitions as a sequence of binary educational decisions – can be created both from years of education and educational qualifications (see Section 2.2.2). Examples of this from the USA can be found in Mare (1981) and from 13 industrialised countries in Shavit und Blossfeld (1993). Table 1 presents in simplified form (i.e., without the transitions between individual grades) an example of such a transition sequence in Germany (general education school and higher education sector only). Each step is relevant only for individuals with Value 1 in the previous transition.

Table 1: Sequence of dichotomous educational transitions in Germany

Transition	Value 0	Value 1
1	Lower secondary not successfully completed	Lower secondary successfully completed
2	No transition to general upper secondary education	Transition to general upper secondary
3	General higher education entrance qualifica-	General higher education entrance qualifi-

	tion (*Abitur*) not obtained	cation (*Abitur*) obtained
4	No transition to university	Transition to university
5	No university degree obtained	University degree obtained

In view of the heterogeneity of educational careers, the reconstruction of educational transitions from the highest qualification obtained or from years of education is sometimes considered to be inappropriate (Breen et al., 2009). As described in Section 2.2.3, this type of modelling, and thus coding, has also been increasingly criticised because of the high degree of unobserved heterogeneity of the categories, especially in stratified education systems (note the absence of the transition from primary to tracked lower secondary education as well as vocational education and training in Table 1). Therefore, binary education variables are not very suitable as independent variables either, unless the underlying theory offers strong arguments for such effects (e.g., general higher education entrance qualification obtained or not obtained in the case of the prediction of the transition to higher education).

4.2.2 The CASMIN educational classification

The CASMIN educational classification (Brauns, Scherer, & Steinmann, 2003; König, Lüttinger, & Müller, 1988) was developed within the framework of the Comparative Analysis of Social Mobility in Industrial Nations project specifically for cross-national comparative research on social mobility. It has since been used in numerous comparative studies in this field (Breen et al., 2009; Breen, Luijkx, Müller, & Pollak, 2010; Erikson & Goldthorpe, 1992; Shavit et al., 2007; Shavit & Müller, 1998), and it is deemed by the scientific community to be very valid (see, e.g., Kerckhoff, Ezell, & Brown, 2002; Schneider, 2010). In most cases, CASMIN is generated ex post from existing data. However, individual data sets, for example the German Socio-Economic Panel (SOEP; Wagner et al., 2007), also provide CASMIN directly.

The CASMIN schema conceptualises education as a means of selecting individuals into positions in the social class structure. These selection processes are mediated by educational certificates, which are thus the unit to be classified. The categories are supposed to be functional equivalents in the sense of the selection effects of educational qualifications both in terms of the selection within the education system and the related access to privileged positions in the labour market. Therefore, not only are hierarchical levels of education (in the sense of duration, quality, and value) distinguished but also general education and vocational qualifications or "tracks" within each level. These categories also reflect different socialisation milieus. Table 2 shows the CASMIN categories following Brauns et al. (2003, Table 1) and the attempt to allocate current German educational qualifications not yet covered there.

Table 2: CASMIN Classification 2003 and its application to educational qualifications in Germany

Category	Description	Allocated German qualifications
1a	Inadequately completed general education	No educational certificate

1b	General elementary education (compulsory schooling) – "social minimum of education"	Hauptschule/Volksschule certificate
1c	Basic vocational training above and beyond compulsory schooling	*Hauptschule/Volksschule* certificate with an *Anlernausbildung* or a successfully completed apprenticeship (incl. *Meister/Techniker* qualification)
2a	Intermediate vocational qualification or secondary programmes in which general intermediate schooling is combined with vocational training	Intermediate certificate with *Anlernausbildung* or a successfully completed apprenticeship (incl. *Meister/Techniker* qualification)
2b	Intermediate general education; academic or general tracks at the secondary intermediate level	Mittlere Reife (Realschule certificate)
2c_gen	General maturity	*Fachhochschulreife*, *Hochschulreife* (*Abitur*)
2c_voc	Vocational maturity	*Fachhochschulreife* or *Hochschulreife* with an *Anlernausbildung* or a successfully completed apprenticeship (incl. *Meister/Techniker* qualification)
3a_voc	Lower-level lower tertiary degree of shorter duration with vocational orientation	Bachelor's degree or *Diplom* from a non-university higher education institution (e.g., *Fachhochschule*), degree from an *Ingenieurschule*
3a_gen	Lower-level lower tertiary degree of shorter duration with general education orientation	Master's degree from a non-university higher education institution (e.g., *Fachhochschule*)
3b_low	Lower-level higher tertiary degree from a traditional academically oriented university	Bachelor's degree from a university or *Technische Hochschule*
3b_high	Higher-level higher tertiary degree from a traditional academically oriented university	*Diplom* and equivalent or Master's degree from a university or *Technische Hochschule*

However, the CASMIN classification has not been updated since 2003. The greater differentiation of higher education in the course of the Bologna reforms and the expansion of advanced vocational education, in particular, raises questions as to the practical application of the classification. For example, in Table 2 above, Bachelor's degrees from a *Fachhochschule*, a *Berufsakademie*, or the *duale Hochschule*

were allocated to category 3a_voc., although Brauns et al. (2003) leave this category empty in the case of Germany, and Master's degrees from a *Fachhochschule* were allocated to category 3a_gen.[12] A corresponding differentiation was made between Bachelor's and Master's degrees in the case of degrees from traditional academically oriented universities. Moreover, vocational qualifications are not differentiated, so that, with a given school-leaving certificate, it makes no difference whether somebody has completed only a short on-the-job *Anlernausbildung* or obtained a *Meisterbrief*. A further weakness of CASMIN is the fact that mappings are available only for a limited number of countries.

4.2.3 The International Standard Classification of Education 1997 and 2011

Following early developments in the 1950s (UNESCO, 1958), the International Standard Classification of Education (ISCED) was adopted by UNESCO in 1975 for the purpose of enhancing the comparability of international reporting of official education statistics (especially by UNESCO, Eurostat, and the OECD, UNESCO, 1978). The classification was originally used for process-produced data, for example for school attendance figures in different areas of national education systems reported by ministries. Nowadays, however, ISCED is used also for the harmonisation of education data in surveys conducted by international official statistical agencies and the OECD. Many international data sets contain only ISCED variables and no national education variables. The German Socio-Economic Panel (SOEP; Wagner et al., 2007) and the German General Social Survey (ALLBUS) provide ISCED as one of several education variables.

ISCED 1997 (OECD, 1999; Schneider, 2008c; UNESCO, 2006) classifies education programmes rather than educational qualifications. It comprises seven vertical levels of education and diverse horizontal sub-categories. The allocation of educational programmes to levels of education is carried out on the basis of various criteria, which are described in detail in UNESCO (2006) and OECD (1999). These criteria include, for example, the entrance qualifications, the typical starting age, the typical (cumulative) duration, and the programmes in the education system that the programme in question is designed to prepare for. The location of an education programme in typical educational careers is therefore an important classification criterion in this case, which leads to a high degree of circularity. Table 3 shows the seven ISCED levels of education and examples of the educational programmes and qualifications that they comprise in Germany (Hasselborn et al., 2014, Table 1; for a critical evaluation, see Schneider, 2008a).

Table 3: The ISCED 1997 education levels and their application to Germany

	Description	Examples of German educational programmes /qualifications
0	Pre-primary education	*Kindergarten, Vorschule*
1	Primary education	*Grundschule* successfully completed

[12] For Germany, it would obviously be more meaningful to distinguish these degrees according to „3a_low" and "3a_high" equivalent to category 3b, or to allocate Bachelor's degrees to category 3a and Master's degrees to category 3b, and then distinguish them according to "voc" (vocationally oriented higher education institution) and "gen" (traditional, academically oriented university). However, the latter would constitute a major revision of CASMIN.

2	Lower secondary education	*Hauptschule* certificate, *Realschule* certificate (also transition to Grade 11, *Gymnasium*/*Gesamtschule*)
3	Upper secondary education	*Fachhochschulreife*, *Abitur*, apprenticeship, vocational qualification from a *Berufsfachschule*
4	Post-secondary, non-tertiary education	*Abitur* and apprenticeship or vocational qualification from a *Berufsfachschule*
5	First stage of tertiary education	Qualification from a *Fachschule*, *Berufsakademie*, *Fachakademie*, *Fachhochschule*, university
6	Second stage of tertiary education	Doctoral degree

These superordinate categories are very heterogeneous, especially in the case of levels 3 and 5. The ISCED sub-categories, which did not yet exist in the 1970s version, are defined in ISCED 1997 on the basis of the following complementary dimensions, which are described in UNESCO (2006):

1. At levels 2, 3, 4, and 5, educational programmes are distinguished according to the destination for which they have been designed to prepare:
    - A: Programmes on a direct pathway to a doctorate, that is, programmes that prepare participants for academic programmes.
    - B: Programmes that prepare participants for entry to more advanced vocational education programmes that are not allocated to category A. Exception: ISCED 5B, which prepares participants only for entry to the labour market.
    - C: Programmes without direct access to more advanced programmes, that is, terminal programmes that prepare participants only for direct transition to the labour market.
2. At levels 2, 3, and 4, the orientation of educational programmes is differentiated as follows:
    - General education. Defined negatively as education that does not prepare participants for employment in a specific occupation or class of occupations.
    - Vocational or technical education. Defined as education that prepares participants for employment in a specific occupation or trade or class of occupations or trades.
    - Pre-vocational or pre-technical education. Defined as education that prepares participants for entry into vocational or technical education programmes, but which does not itself lead to a labour-market relevant vocational or technical qualification.
3. Levels 3 and 5 are differentiated according to the duration of the respective educational programmes.
    - At level 3 (in practice only in category C) this distinction serves to identify qualifications that cannot be deemed to be full upper secondary qualifications:
        - Short educational programmes last less than two years
        - Long educational programmes last two years and more

- At level 5, this distinction serves to differentiate types of tertiary qualifications, especially qualifications at Bachelor's and Master's level:
    - Short educational programmes last between two and less than three years
    - Medium educational programmes last between three and less than five years
    - Long educational programmes last between five and less than six years
    - Very long educational programmes last longer than six years

Not all logical possibilities occur in practice, and some (e.g., orientation and destination) overlap considerably in many countries. General programmes are almost always assigned to category A. However, there are also vocational programmes at level 3 that keep access to tertiary education open and are thus also allocated to category A. In addition, educational programmes in ISCED 5A are defined as having a minimum duration of three years. Qualifications from short academic programmes must be allocated to ISCED 4, even if they are perceived nationally as tertiary. However, this does not always happen. Especially in the area of vocational education, the boundaries between ISCED levels 4 and 5 are very vague. While Luxembourg classifies its *Meister* programmes into ISCED 4, Germany, Austria, and Switzerland have "agreed" on ISCED 5B, which is extremely debatable. In some countries, for example Great Britain, the differentiation between ISCED 2 and 3 is controversial (Schneider, 2008b).

The official mappings of national educational programmes to ISCED 1997 can be found on the UNESCO Institute for Statistics (UIS) website. However, it is unclear whether these mappings have been used for specific data harmonisations (e.g., the EU-LFS in a particular year). The ISCED 2011 mappings are continuously published on the same website. Combined ISCED 1997 and 2011 mappings from the year 2013 onwards are also available for European countries at https://circabc.europa.eu/w/browse/c2dc65ad-5163-4935-b0c2-e5ea1f44929b.

Most data sets still feature the 1997 version of ISCED. However, ISCED 1997 soon became obsolete as a result of the Bologna reforms, which were adopted in the same year. ISCED 2011 (OECD, Eurostat, & UNESCO Institute for Statistics, 2015; Schneider, 2013; UNESCO Institute for Statistics, 2012) has been implemented in all official surveys since 2014. While ISCED 1997 cannot be readily converted into ISCED 2011, ISCED 2011 can be roughly converted into ISCED 1997:

Table 4: Correspondence between the levels of education in ISCED 1997 and ISCED 2011

ISCED 2011		ISCED 1997	
Level	Label	Level	Label
0	early childhood education (attainment: less than primary education)	0	pre-primary education
1	primary education	1	primary education
2	lower secondary education	2	lower secondary education
3	upper secondary education	3	upper secondary education
4	post-secondary non-tertiary education	4	post-secondary non-tertiary education
5	short cycle tertiary education	5	first stage of tertiary education
6	bachelor level education and equivalent		
7	master level education and equivalent		
8	doctoral level education	6	second stage of tertiary education

The following changes were implemented in ISCED 2011:

1. In contrast to ISCED 1997, ISCED 2011 explicitly classifies not only educational programmes but also educational *qualifications*. This is a response to the increasing application of ISCED to measure individual educational attainment in surveys. In this context, it is particularly important that a qualification from an educational programme at ISCED level X that does not meet the minimum duration requirements be allocated to level X-1 (see OECD & Eurostat, 2014: 9f.). Qualifications that are allocated to the "partial level completion" category (which should not be misinterpreted as meaning that that the individual dropped out of a programme) are sometimes allocated to level X and sometimes to level X-1 (OECD & Eurostat, 2014: 7f.). Qualifications from outdated programmes, that is, programmes that no longer exist, should be classified in ISCED on the basis of the characteristics of those programmes rather than allocating them to a current national equivalent (OECD & Eurostat, 2014: 10; UNESCO Institute for Statistics, 2012, §88). This should improve the comparability of the ISCED levels.

2. The tertiary level was further differentiated to enable educational programmes and qualifications that are equivalent to Bachelor's or Master's level to be identified in education statistics. Level 5 in ISCED 1997 was therefore subdivided into levels 5, 6, and 7. What was formerly level 6 became level 8. The designation of level 8 was also changed because the designation used in ISCED 1997 was often misunderstood to mean Master's level. In Table 4, the educational levels of both versions are directly compared.

3. The sub-category "pre-vocational and pre-technical education" was done away with. The corresponding educational programmes are now classified as "general education" because they do not provide labour-market relevant qualifications.

With ISCED 2011, a coding scheme was introduced to facilitate standardised data processing. The resulting coding scheme for ISCED-A (i.e. educational qualifications/level of educational attainment) is presented in Table 5. The next section and Table 7 show how these detailed codes can be aggregated to create a variable that is sufficiently differentiated yet statistically manageable.

Table 5: List of the ISCED 2011 codes for educational qualifications/level of educational attainment (ISCED-A)

0 Less than primary
01 never attended an educational programme
010 not further defined
02 some early childhood education
020 not further defined
03 some primary education (without level completion)
030 not further defined
1 Primary
10 not further defined
100 not further defined
2 Lower secondary
24 general
242 partial level completion and without access to upper secondary
243 level completion but without direct access to upper secondary
244 level completion with direct access to upper secondary[1]
25 vocational
252 partial level completion and without access to upper secondary
253 level completion but without direct access to upper secondary
254 level completion with direct access to upper secondary[1]
3 Upper secondary
34 general

342 partial level completion and without access to tertiary

343 level completion but without direct access to tertiary

344 level completion with direct access to tertiary[1]

35 vocational

352 partial level completion and without access to tertiary

353 level completion but without direct access to tertiary

354 level completion with direct access to tertiary[1]

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4 Post-secondary non-tertiary

44 general

443 level completion but without direct access to tertiary education at ISCED 5, 6 or 7

444 level completion with direct access to tertiary education at ISCED 5, 6 or 7[1]

45 vocational

453 level completion but without direct access to tertiary education at ISCED 5, 6 or 7

454 level completion with direct access to tertiary education at ISCED 5, 6 or 7[1]

5 Short cycle tertiary

54 general

540 not further defined

55 professional

550 not further defined

56 orientation unspecified[1]

560 not further defined

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6 Bachelor or equivalent

64 academic

640 not further defined

65 professional

650 not further defined

66 orientation unspecified[2]

660 not further defined

7 Master or equivalent

74 academic

740 not further defined

75 professional

750 not further defined

76 orientation unspecified[2]

760 not further defined

8 Doctoral or equivalent

84 academic

840 not further defined

85 professional

850 not further defined

86 orientation unspecified[2]

860 not further defined

9 Not elsewhere classified

Notes:

[1] Including successful completion of a programme or stage of a programme at a higher ISCED level insufficient for level completion or partial completion.

[2] To be used in the absence of internationally agreed definitions of academic and professional orientations of qualifications (or intermediate qualifications) from the successful completion of programmes (or stages of programmes) at ISCED levels 6-8.

Both CASMIN and ISCED allow, in principle, the identification of specific educational programmes, qualifications, or levels. This may be essential from a theoretical perspective (see Sections 2.1.2 and 2.2.3), so that that the question of alternative – especially interval-scaled – education variables does not arise in the first place. ISCED and CASMIN have been empirically evaluated by several studies

(Braun & Müller, 1997; Kerckhoff & Dylan, 1999; Kerckhoff et al., 2002; Schneider, 2008c, 2009, 2010). Advantages and disadvantages were identified in the case of both approaches. They related to how well the respective classifications fitted the education systems observed. In particular, excessive aggregation of levels of education and neglect of horizontal differentiations (e.g., between vocational and general education qualifications) lead to problems of validity in many countries, which thereby also limit the cross-national comparability of the resulting variables. A decisive advantage of CASMIN is that it gives great consideration to access to higher education as a differentiation criterion that has proved to be even more important than the differentiation between general and vocational education qualifications (Schneider, 2010), which are also distinguished within CASMIN. There are a number of other aspects that can be used as arguments for or against the use of CASMIN or ISCED. They are summarised in Table 6.

Table 6: Advantages and disadvantages of CASMIN and ISCED

	CASMIN	ISCED
Updating	Ad hoc by scientists	Every 10-20 years, by UNESCO
Latest version	2003	2011
Countries covered	Mainly Western Europe, a few Eastern European countries	Practically worldwide
Dissemination in secondary data	Low, mostly ex post	Broad, however different versions
Theory-driven development	Yes (social mobility theories)	No
Political interference	None	Possible, depends on country
Differentiation of secondary education	Good, pragmatic	Partial, but rarely implemented in practice
Differentiation of higher education degrees	Good but needs updating	Problematic
Differentiation of general and vocational education	Good	Good, in principle, but not implemented in most data sets

4.2.4 Variants of ISCED in academically driven social research

ISCED has established itself in survey research as a harmonisation tool for education-related data. However, criticism has been voiced from two directions. First, for the most part in international surveys, only the ISCED 1997 levels of education are used, and often only in aggregated form. Since most respondents in developed countries are concentrated at levels 3 and 5, the validity of the resulting ISCED 1997 variable may be considered low (Müller & Klein, 2008; Schneider, 2010).[13] Second, the definitions and mappings of national educational programmes and qualifications to ISCED categories are criticised (Kieffer, 2010; Schneider, 2008c, 2009). Mappings, in particular, are a weak point of ISCED because political interference is widespread (see also Steedman & McIntosh, 2001, Footnote 3): The mappings are usually developed by education ministries and statistical offices, and in some countries other stakeholders have a say (however, researchers rarely do). This process is not transparent. Therefore, variants of ISCED that are oriented towards the needs of social science research have been developed. These

[13] It remains to be seen how this will develop as a result of the increasing use of ISCED 2011.

variants are used in academically-driven (as opposed to official) social surveys and they will be presented in what follows.

In the ESS, the measurement of educational attainment was fundamentally revised for ESS Round 5 (2010). First, a three-digit system of categories was developed, which is oriented towards ISCED 2011 and allows for the approximate derivation of both ISCED 2011 and ISCED 1997. Additional differentiations were introduced on the second and third digit. These differentiations are important for social science research but are lacking in ISCED. They involve, on the one hand, the distinction between different levels of general education qualifications at lower and upper secondary level, which play a major role in some European (and especially German-speaking) countries, and, on the other hand, the distinction between academically/theoretically oriented and application-/practice-oriented tertiary education. Schröder and Ganzeboom (2013) noted that the resulting variable, **"edulvlb"**, does not lead to loss of information compared to country-specific variables. To enable this detailed harmonisation, the measurement instruments in all participating countries were revised. Moreover, deviations from the official ISCED mappings were provided for and documented (European Social Survey, 2012a) in order to maximise comparability across countries.

A simplified variable – the "European Survey Version of ISCED (ES-ISCED)" – was then derived from the detailed cross-nationally comparative variable **"edulvlb"**. Designed to be applicable for many analytical purposes, ES-ISCED differentiates the orientation of the educational programme, especially at upper secondary level, according to whether it prepares for tertiary education or for the labour market (although educational programmes that prepare participants for tertiary level may also be vocationally oriented!). This ensures that not all upper secondary programmes are concentrated in one category (in some countries, around 75% of the population have an upper secondary qualification), but rather that programmes are distinguished according to whether they provide access to tertiary education or are exclusively vocationally oriented. This makes good sense analytically because these distinctions are decisive both for socialisation in different learning environments in adolescence and for further educational and employment opportunities. Moreover, ES-ISCED distinguishes between qualifications below Bachelor's level, at Bachelor's level, and above Bachelor's level, but does not distinguish doctoral level (a category that is sparsely occupied in all countries). Hence, ES-ISCED endeavours to combine CASMIN and ISCED in such a way that the advantages are maximised and the disadvantages are minimised (see also Table 6), and thereby achieves high validity across countries (Schneider, 2009, 2010). Table 7 shows the differentiated coding scheme for EDULVLB and its links to ISCED 2011, ISCED 1997, and ES-ISCED.

The ISSP switched to an ISCED-like education variable in 2011 that was inspired by ES-ISCED, without however taking the "detour" via a differentiated education variable such as "edulvlb". The ISSP variable, DEGREE, defines seven categories, whereby categories 0 to 2 correspond to the respective ISCED 1997 levels. Category 3 aggregates ISCED 3A and 4A, and category 4 aggregates ISCED 3B, 3C, 4B, and 4C. At tertiary level, category 5 is reduced to ISCED 5B and 5A medium, and category 6 is extended correspondingly by adding 5A long. In this way, the various categories are more uniformly occupied, and the information content is substantially increased.

While no satisfactory cross-national comparative "multi-purpose coding" of education was in sight 20 years ago (Braun & Müller, 1997), survey research has since been able to move a bit closer to this goal. It remains to be seen whether other surveys take up the developments in the ESS, as has already oc-

curred, in part, in the Survey of Health, Ageing and Retirement in Europe (SHARE). Moreover, ISCED 2011 and schemes that are based on it will have to be regularly adapted to changing education systems and effects.

Table 7: Correspondence between "edulvlb", ISCED 2011, ISCED 1997 and ES-ISCED in the ESS

EDULVLB Code	Description	ISCED 2011	ISCED 97 Level	ES-ISCED
000	Not completed primary education	000	0	1
113	Achieved certificate from an ISCED 1 programme, or completed an ISCED 1 programme that does not provide any certificate	100	1	1
129	Achieved certificate from a short vocational ISCED 2 programme	100	1	1
212	Achieved certificate from a general/pre-vocational ISCED 2 programme giving access to ISCED 3 (vocational only)	244	2	2
213	Achieved certificate from a general ISCED 2 programme giving access to ISCED 3 (general or all)	244	2	2
221	Achieved certificate from a long vocational ISCED 2 programme not giving access to ISCED 3	253	2	2
222	Achieved certificate from a vocational ISCED 2 programme giving access to ISCED 3 (vocational only)	254	2	2
223	Achieved certificate from a vocational ISCED 2 programme giving access to ISCED 3 (general or all)	254	2	2
229	Achieved certificate from a short vocational ISCED 3 programme	255	2	2
311	Achieved certificate from a general ISCED 3 programme without access to tertiary considered as level 3 completion	343	3	3
312	Achieved certificate from a general ISCED 3 programme preparing for *lower tier* ISCED 5A or 5B, but not upper tier 5A	344	3	4
313	Achieved certificate from a general ISCED 3 programme preparing for *upper/single tier* ISCED 5A	344	3	4
321	Achieved certificate from a long vocational ISCED 3 programme not giving access to ISCED 5	353	3	3
322	Achieved certificate from a vocational ISCED 3 programme giving access to ISCED 5B or *lower tier 5A, but not upper tier 5A*	354	3	4

323	Achieved certificate from a vocational ISCED 3 programme giving access to *upper/single tier ISCED 5A*	354	3	4
412	Achieved certificate from a general ISCED 4 programme giving access to *lower tier ISCED 5A or ISCED 5B, but not upper tier 5A,* without prior completion of 3B/3C	444	4	4
413	Achieved certificate from a general ISCED 4 programme giving access to *upper/single tier ISCED 5A,* without prior completion of 3B/3C	444	4	4
421	Achieved certificate from a vocational ISCED 4 programme not giving access to ISCED 5	453	4	5
422	Achieved certificate from a vocational ISCED 4 programme giving access to *lower tier ISCED 5A or ISCED 5B, but not upper tier 5A,* or general ISCED 4 after completing ISCED 3B/C programme	454	4	4
423	Achieved certificate from a vocational ISCED 4 programme giving access to *upper/single tier ISCED 5A*, or general ISCED 4 after completing vocational ISCED 3B programme	454	4	4
510	Achieved general/academic tertiary certificate below bachelor's level (level 6xx) after 2-3 years of study	540	3	5
520	Achieved vocational tertiary certificate below bachelor's level (level 6xx) after 2-3 years of study	550, 560	5	5
610	Achieved 1st *polytechnic/applied/lower tier college* degree after 3-4 years	650	5	6
620	Achieved 1st *upper/single tier university* degree after 3-4 years of study	640, 660	5	6
710	Achieved 1st *polytechnic/applied/lower tier college* degree after more than 4 years of study or 2nd or further lower tier college degree	750	5	7
720	Achieved 1st upper/single tier university degree after more than 4 years of study or 2nd or further upper/single tier university degree below the doctoral level	740, 760	5	7
800	Doctoral degree	800	6	7

4.2.5 Application of international standard variables in practice

Despite existing "standards," virtually every survey implements a different cross-nationally comparable education variable. This is due to the fact that the standards are often under-specified and, until re-

cently in the case of ISCED, they did not specify a coding scheme – which is something that the International Standard Classification of Occupation (ISCO) started providing long ago (see e.g. Elias, 1997; International Labour Organisation, 2007). Moreover, the present standards are insufficiently documented, can be interpreted differently, and coordination is lacking *between* studies in order to ensure consistency (see the different variables in the ESS and the ISSP). Hence, with each cross-national comparative study, data users have to familiarise themselves with a new coding scheme. In the course of the implementation of ISCED 2011, the OECD and Eurostat (2014) published joint guidelines for official statistical agencies for the implementation of ISCED in household surveys.

The mapping of country-specific education categories to international education categories has been created afresh by almost every (international) survey. This is due to the fact that, until recently, the official harmonisation routines were almost unknown, with the result that different mappings have sometimes been produced for the same country and the same qualification, and the classification criteria have been interpreted and applied quite differently across countries. This in turn is due to the fact that the official mappings (see Section 4.2.3) have not been published until quite recently. In addition, in official statistics microdata, only the cross-national comparative variable but not the underlying country-specific variables are published. It should be pointed out, however, that these mappings do not directly relate to country-specific measurement instruments, which, as already described in Section 2.3, are often not standardised across studies even for the same country anyway. Hence, the harmonisation routines cannot be transferred directly from one study to another but rather must first be examined and adapted.

Inconsistencies in the mapping of education categories and in the resulting distributions are therefore to be expected across surveys and over time, which make comparison of the results and a joint analysis more difficult. This has also been demonstrated by various studies (Gesthuizen, Solga, & Künster, 2011; Kerckhoff & Dylan, 1999; Ortmanns & Schneider, 2015; Schneider, 2009).

4.2.6 Aggregation of detailed educational categories

For the preparation of the data for statistical analysis, the practical question that arises is which categories of a detailed classification can be merged. It is hardly possible to give a general answer to this question. The theoretical background may provide information, for example whether a distinction should be made between general and vocational education or whether certain differentiations (e.g., within tertiary education) might play a role. As a rule of thumb, at least four categories should be distinguished – the frequently applied reduction to only three educational levels ("low, medium, high") leads to such heavy losses of information that validity is severely restricted (see, e.g., Braun & Müller, 1997; Müller & Klein, 2008; Schneider, 2010). However, it also depends on *how* these categories are formed (Kerckhoff & Dylan, 1999). Therefore, it is always useful to use sensitivity analyses to *empirically* test whether the merging of educational categories has consequences for the computed model and, if yes, to choose the required level of differentiation.

5 Summary and outlook

The present contribution endeavours to provide an overview of education concepts and indicators, their statistical modelling, and the necessary measurement instruments and coding schemes for Germany in international comparisons. It was possible to draw on many years of research on educational inequality and returns to education, in the course of which numerous approaches to the measurement of education have been developed as a reaction to too narrowly defined concepts and theories, newly developed statistical models, and better availability of data, on the one hand, and to the dynamic development of modern education systems, on the other. Even though many surveys are not directly interested in education and social structure, high quality standards should also be applied to the measurement and coding of background variables in order to obtain coefficients of the variables of theoretical interest in statistical models that do not contain hidden effects of background variables that have been only partially measured.

The degree of standardisation of instruments for the measurement of educational attainment and the harmonisation of these instruments across surveys is quite low. This is true not only of German surveys, and it is often due to the specific objective of the survey. For example, surveys whose main topic is education measure education in a more differentiated way than surveys in which education is only a background variable. The advantages of standardisation are well known:

- Comparability across surveys is ensured only if comparable measurement instruments are used. Data from surveys with standardised measurement instruments are easier to cumulate and jointly analyse, which opens up new potential for analysis without having to conduct a new survey.
- Comparisons with official statistics are helpful in order to assess the quality of survey data. Here, too, the derivation of weights to correct for nonresponse bias is easier if the survey data are compatible with official statistics data.
- The development and publication of coding routines that can be used by other data users is worthwhile only if the variables in question have been coded in a standardised way. New variables can then be derived from the existing variables in a standardised way, too. Thus, standardisation increases the efficiency and the cumulative character of research.

If possible, therefore, education should be measured with standardised instruments such as those developed and documented in the Demographic Standards for Germany (Hoffmeyer-Zlotnik et al., 2010) and it should be coded in a standardised way.[14] However, in most countries, a standard measure that can accommodate future changes in the education system, that finds broad acceptance in the scientific community and the official statistical agencies, and that continues to allow comparisons with older data to be made would first have to be developed. Moreover, cross-national comparability should be ensured or existing international standards applied.

As always in the case of harmonisation-related issues, the establishment of international comparability without completely losing sight of the appropriate representation of local circumstances is a great challenge. The contradictory empirical results and the slow theoretical progress in comparative research

[14] The weaknesses mentioned in Section 3.3.1 will probably be remedied in the next version.

on social structure is due to a large extent to problems of data comparability, especially the comparability of education variables (Breen & Jonsson, 2005). Unfortunately, the samples used by surveys that collect data explicitly for the purpose of cross-national comparison, such as the ESS and the ISSP, are still too small to allow comparative analyses of social structure with differentiated categorical variables. This can be remedied only to a limited degree by cumulating data, because the education variables have usually been improved over time, so that for cumulations one is obliged to use poorer quality codings that can be applied to all survey waves. In the long term, cross-survey, cross-national, and perhaps even cross-disciplinary, standards would be helpful. A big challenge in this regard is to balance the interests of the official statistical agencies, academic social researchers and all participating countries. As a first step, it would be helpful if the major cross-national comparative surveys could agree on common standards. A cross-national survey project for research on social structure, as proposed by Breen and Jonsson (2005), is not yet in sight.

With regard to the coding of education, one can sum up by saying that, in contrast to nominal education variables, every ordinal- or interval-scaled coding of education is based on a one-dimensional concept of education, where education can be regarded as a continuous latent variable that expresses "more" or "less" education – sometimes in an absolute and sometimes in a relative sense (see Chapter 2). Opinion is divided on the validity of a one-dimensional measurement for the analysis of education. Empirically, in addition to pronounced linear effects, categorical effects of the parental occupational group or social class on vocational (as opposed to academic) education can be identified that cannot be reduced to additional linear dimensions (see H. L. Smith & Garnier, 1987). In social structure analyses that use education as an independent variable, years of education lead almost always to a poorer model fit (e.g., adjusted R^2) than educational qualifications in categories (Braun & Müller, 1997; De Graaf & Ultee, 1998; Schneider, 2010). For the USA, too, so-called „sheepskin" effects have been demonstrated (Goodman, 1979; Hungerford & Solon, 1987; Jaeger & Page, 1996). However, there are also counterexamples (Helberger, 1988), and hardly any relevant studies have been conducted outside social structure research.

Other fields of research may be less demanding with regard to the degree of differentiation with which education should be measured. Nonetheless, it is advisable to have a clear picture of what education means in the context of a specific survey, and to specify the concept, the indicator, the measurement instrument and the variables accordingly. Ultimately, the highest educational qualification as a categorical variable also contains a lot of residual heterogeneity with regard to the individual level of education beyond the pure certificate, because (a) final grades, (b) educational careers, (c) the quality and prestige of educational programmes and institutions, (d) whether the education provider is public or private, (e) only partially completed educational programmes (i.e., dropout), (f) continuing education and training, and (g) the field of education remain hidden to the empirical analysis – or must be measured separately. Standardised and cross-nationally comparable measurement instruments and codings should if possible also be developed and tested for these concepts.

Nowadays, many educational qualifications can be obtained at different educational institutions or in different educational programmes. In Germany, for example, a Bachelor's degree can be obtained at a *Berufsakademie*, a *Fachhochschule*, or a (traditional) university; the entrance qualification for a *Fachhochschule* (*Fachhochschulreife*) can be obtained at a *Gymnasium*, a *Gesamtschule*, or a *Fachoberschule*; and the general higher education entrance qualification (*Abitur*) can be obtained at a *Gym-*

nasium, a *Gesamtschule*, or an *Abendgymnasium*. For graduates, these different educational institutions mean different socialisation conditions and public perceptions and stereotypes about the respective institutions (e.g., their performance expectations and disciplining capacity; Müller, 1979). Without distinguishing between school types across federal states, the implications of the related institutional differences cannot be investigated. On the other hand, there are major differences between schools of the same designation or the same type that can hardly be captured in general surveys. There are still no suitable instruments with which educational institutions can be measured.

Moreover, consideration should be given to whether – in the interests of sensitivity for horizontal inequalities – fields of education and training should be collected. Müller (1979) recommended, for example, differentiating between industrial and commercial apprenticeships because industrial apprenticeships prepare participants for manual occupations and commercial apprenticeships prepare for non-manual occupations, and they thus differ greatly in terms of the related status and opportunities. However, the same objective can be achieved by controlling for these occupational characteristics by means of a separate variable instead of confounding this dimension with the education concept. Fields of education can be coded by means of a separate ISCED classification – ISCED 2013-F – created especially for this purpose (UNESCO Institute for Statistics, 2013). However, this classification has not yet been tested for social science purposes.

Both horizontal differentiation and positional concepts of education play an increasingly important role in the conceptualisation and measurement of education. To date, no attempts have been made to combine the two perspectives and to generate a horizontally differentiating positional measure of education or to create models that take both elements into account. Goldthorpe (2014), for example, argued that labour markets differ depending on the occupation in question and that some occupations make absolute educational demands while others recruit positionally. Rotman, Shavit, and Shalev (2016) argued that the significance of relative and absolute education also depended on the way in which a country's labour market was organised (Maurice, Sellier, Silvestre, & Goldhammer, 1986): Positional education is more important in "organisational spaces," and absolute education is more important in "occupational spaces" (Rotman et al., 2015). Hence, the possibilities of measuring education, which are already almost too numerous to manage, are unlikely to decrease in number but rather must be researched further.

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